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ABSTRACT

This booklet is intended to accompany lessons dealing with threats to human survival. It addresses both natural and man-made disasters. Chapters present photos and diagrams along with descriptions of specific threats and suggested approaches to dealing with them. Chapters include: (1) Disasters, (2) Survival in the Nuclear Age, (3) Civil Preparedness in Other Nations, (4) Civil Preparedness in Time of Emergency, (5) Population and Pollution and Petroleum, (6) Air Pollution, (7) Noise Pollution, (8) Water Pollution, (9) Energy, (10) Drug Abuse Problems, (11) Crisis in the Streets, and a closing section of conclusions. (RE)

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STATE OF ALABAMA
DEPARTMENT OF EDUCATION
MONTGOMERY, ALABAMA

Bulletin 1976, No. 16

SE 031 903

THE CHALLENGE OF SURVIVAL

STATE OF ALABAMA
DEPARTMENT OF EDUCATION
MONTGOMERY, ALABAMA

WAYNE TEAGUE
State Superintendent of Education

WILLIAM C. BERRYMAN
Director, Division of Instruction

Bulletin 1976, No. 16

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PREFACE

Man has always been involved with the challenge of survival. In some of the first examples of recorded history man was seen as an individual struggling against his fellow cave dwellers, the wild animals, and the natural environment. His determination to survive was soon coupled with the knowledge which enabled him to extend his span of life. The pattern of a primitive culture evolved from the requirement that man must work with man in order to create a more secure way of life. But in each instance the challenge was individual -- man had to think for himself and man had to want to survive. He soon learned how to survive better by working with others and by adjusting to the needs dictated by his environment. The natural environment that faced him was his greatest friend and his worst enemy. He struggled to understand it and to conquer it.

Today, modern man faces the same types of problems. How do we solve the issues that relate to pollution, drug abuse, natural disasters, law enforcement, and the threat of nuclear war?

The United States is an extremely diverse country. The climate, soil, topography, and population are varied and complex. What survival problems exist in one area may not exist in another. Man-made and natural disasters will reflect the peculiar nature of that part of our country. Energy as well as drug abuse problems will vary with the geographic region. The student should recognize these differences and also understand that because of these regional peculiarities it is essential that we build together for a better tomorrow. The struggle for freedom is an inherent dream, but the compromises that modern man faces are difficult tasks. It is an inevitable truth that the freedom of one man may well interfere with the freedom of another. These problems and the others reflected in the pages that follow can be faced with wisdom and understanding. With such wisdom and understanding man can survive.

Wayne Teague

Wayne Teague
State Superintendent of Education

FOREWORD

The State Department of Education, in cooperation with the State Department of Civil Defense, has developed this course of study and this textbook with emphasis on survival. The many problems and solutions that this book presents could be those that confront you in the future, and as a result of your study of this material, you will be better prepared to cope with emergencies and to assist other Alabamians who have not been as fortunate as you in receiving this training.

The objective of this course is not just to present you with something else to study and take up your time, but to offer you something that will be useful the remainder of your lives.

Alabama is privileged to have been given the opportunity to develop a pilot program for our Nation as well as for our State. I know that you will take advantage of this and prove to our country the value of such a program.

As your Governor, I feel certain that you will find the course meaningful, practicable, and challenging.

Wishing for you a most enjoyable and successful future, I remain

Sincerely,

George C. Wallace
Governor

INTRODUCTION

The State of Alabama has been subjected to more major natural disasters in the last three years than in the previous 50 years.

The devastating tornado of May 27, 1973, destroyed part of Greensboro in Hale County, 90 percent of Brent in Bibb County, and did major damage in several other locations. This tornado lasted nearly two hours and cut a path of destruction nearly 135 miles long. In the town of Brent five people were killed and 56 were injured.

On March 16, 1973, heavy rainfall in the Tennessee and Tombigbee River Basins produced flash flooding that caused millions of dollars of property damage in Huntsville and Madison County.

The Alabama super outbreak of tornadoes occurred on April 3, 1974, when ten confirmed tornadoes struck North Alabama counties. These tornadoes produced 77 deaths and 938 injuries. Guin in Marion County was severely damaged by a tornado that might be the most powerful one to ever strike Alabama. The speed of the tornado was estimated at 65 to 75 miles per hour. It struck at 8:04 p.m. killing 23 and injuring 250 persons mostly in the town of Guin.

Hurricane Eloise struck on September 23, 1975. This hurricane did considerable damage in 15 southeast Alabama counties. Several schools were severely damaged along with many other public and private buildings.

Students can readily see what impact natural disasters have had on the safety and welfare of Alabamians. Your studies in the coming weeks will reveal many important facts about all types of disasters. The knowledge you gain from these studies has life-saving potential.

TABLE OF CONTENTS

PREFACE, BY DR. WAYNE TEAGUE		II
FOREWORD, BY GOVERNOR GEORGE C. WALLACE		III
INTRODUCTION		IV
CONTENTS		V

CHAPTER	TITLE	PAGE
ONE	DISASTERS	1
TWO	SURVIVAL IN OUR NUCLEAR AGE	63
THREE	CIVIL PREPAREDNESS IN OTHER NATIONS	90
FOUR	CIVIL PREPAREDNESS IN TIME OF EMERGENCY	97
FIVE	POPULATION - POLLUTION - PETROLEUM	108
SIX	AIR POLLUTION	113
SEVEN	NOISE POLLUTION	127
EIGHT	WATER POLLUTION	140
NINE	ENERGY	161
TEN	DRUG ABUSE PROBLEMS	164
ELEVEN	CRISIS IN THE STREETS	183
CONCLUSION		193

Do Not Film This Page

CHAPTER ONE

DISASTERS

Introduction

Natural disasters occur in all parts of the United States. The nature of the disaster threat differs with the geographical location.

All parts of the nation may be subjected to some type of natural disaster.

Some parts of the nation suffer the ravages of hurricanes. Tornadoes annually inflict death and destruction to many areas of the country. Winter storms produce an economic loss as well as loss of lives.

What natural disasters do you perceive as a threat to you? Your community?

The population of the United States continues to grow. Construction of new buildings is increasing at an unprecedented rate.

What do you think the results will be if natural disasters occur at the same rate and the trends in population and construction continue?

An analysis of the extent and nature of the natural disaster threat for your area is a prerequisite to good planning.

Prediction and warning of the possibility of occurrence of some natural disasters have improved. Governmental cooperation and planning have improved. This has resulted in a reduction in the number of deaths and injuries.

The response to the needs of victims of disasters has improved due to the enactment of federal laws and programs.

Disaster preparedness programs are designed to create an awareness of the nature of the natural disaster threat, actions to be taken if a disaster occurs, and the assistance that is available if you become a victim of a disaster.

Do you know what the safety rules are for individuals when a tornado threatens? A hurricane? Lightning?

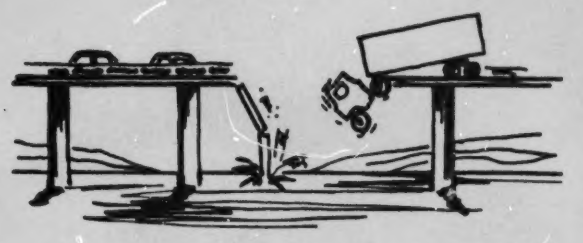
These and other topics will be discussed in this chapter. The information presented in the sections which follow reflect

DISASTERS

WINDSTORM

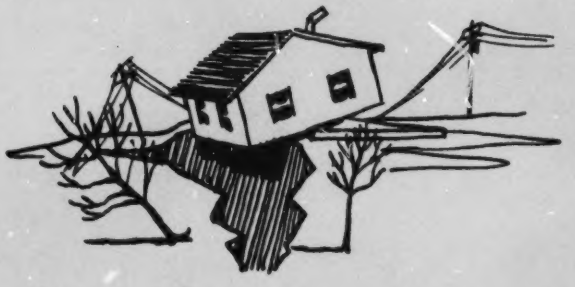
FIRE

SNOWSTORM



BRIDGE COLLAPSING

NUCLEAR ATTACK



EARTHQUAKE

an approach to preparing the individual for emergencies or disasters. An aware and informed citizen can better contribute to the solution of disaster preparedness problems, rather than being a part of the problem.

Weather detection equipment has helped us to improve our capability to warn people. The Synchronous Meteorological Satellite Program of the National Oceanic and Atmospheric Administration (NOAA) is constantly providing better information for use by meteorologists in predicting natural phenomenon such as hurricanes.

Weather modification studies indicate that a degree of control is possible for some natural phenomenon. Until significant progress is made in altering or eliminating certain natural disaster hazards, man must plan and act to reduce the effects of disasters on people and property.

Thunderstorms

The thunderstorm is a weather disturbance that occurs in practically all areas of the nation. The severity of the thunderstorm depends upon many factors. Circulation of air masses, heat content of the air, and water vapor in the air are all factors in the formation of thunderstorms. The thunderstorm produces associated hazards of lightning, strong winds, hail, heavy rain, and in some instances tornadoes. Annually, the majority of the nation is subjected to over 80 thunderstorm days (visual 2).

It is estimated that some 1,800 thunderstorms are in progress over the earth's surface at any given moment, and that lightning strikes the earth 100 times each second. A thunderstorm may be several miles across at its base and may reach an altitude of 40,000 feet or more.

The mature thunderstorm may produce hazards such as hail, heavy rains, lightning, and tornadoes. These hazards will be discussed in sections to follow.

Visual 2

Visual 3

Visual 4

Visual 5

What Is a Tornado? Tornadoes, though storms of short duration, are the most violent weather phenomena known to man. Tornadoes are violently rotating masses of air that are characterized by a funnel-shaped cloud, usually stretching from the cloud layer to the ground although they do not always touch the ground (visual 3).

The funnel of air rotates in a counterclockwise direction at speeds estimated to be in excess of 300 miles per hour. These severe winds are the reason for the destructiveness of tornadoes.

A tornado may travel along the ground at speeds up to 70 miles an hour but has been known to stand still. An average speed for tornadoes is from 35 to 40 MPH. Its path of destruction may affect an area from one-fourth to three-fourths of a mile wide and cover a distance that extends for many miles. However, they have been known to cover an area of one mile in diameter and travel a path some 300 miles long. A spectacular tornado occurred on May 26, 1917, when it lasted seven hours and twenty minutes and traveled a distance of 293 miles through the states of Illinois and Indiana.

What Causes Tornadoes? Many theories have been advanced as to what generates a tornado, but none has won general acceptance. One theory holds that tornadoes are produced by circulating winds created by temperature changes in the atmosphere. A second theory stressed the effect of converging winds meeting and producing a funnel cloud. Currently scientists seem to agree that neither process produces tornadoes independently. It is most probable that tornadoes are produced by the combined effects of both forces.

The Destructiveness of a Tornado. If there is some question as to the cause of tornadoes, there certainly is no difference of opinion as to the destructive effects of these violent storms (visuals 4 and 5).

The tornado can destroy buildings, make a deadly missile of a piece of straw, uproot trees, and hurl people and animals for hundreds of yards. Tornadoes do their destructive work through the combined action of their rotary winds, flying debris, and the partial vacuum created in the center of the funnel (which, when touching buildings, has the effect of causing them to explode). As a tornado passes over a building, the winds twist and rip at the outside walls while the reduced pressure in and around the tornado's funnel causes explosive pressure differences between the inside of the building and its outside. Walls and windows are collapsed or pushed outward, and the resulting debris is sent flying through the air in a dangerous barrage. Heavy objects (automobiles, storage tanks, even railroad cars) are often lifted as if they were weightless and tossed hundreds of yards away from where they had been to be shattered and mangled upon hitting the ground.

The violent destructive effects of tornadoes have made them the "number one" natural disaster killer in the United States. During the past 50 years tornadoes have killed over 9,000 persons in the United States. Visual 6 gives a detailed breakdown of the number of tornadoes that have occurred during the period 1916-1970 and the loss of life caused by them. In comparison, the other two prime killers, hurricanes and floods, have killed about 5,000 and 4,000 persons, respectively, during that same period.

Frequency of Occurrence. Let us look at some specific examples of tornadoes that have struck communities in the United States in recent years.

Tornadoes have been recorded in every state, but the Midwest and Southeast are the most vulnerable areas. The number of tornadoes that have occurred in each state for a 17-year period are shown in visual 7. One of the most destructive series of tornadoes occurred on April 11, 1965, Palm Sunday. On that day 47 tornadoes struck Midwestern United States. Two hundred seventy-one persons were killed and more than 5,000 injured. Property damage was estimated at $300 million. This record was eclipsed by the April 3-4, 1974, series of tornadoes when 140 struck in a 24-hour period. The series of tornadoes during this period killed 336 people, injured 9,000, and destroyed nearly 5,000 homes.

Tornadoes have been known to occur throughout the year at all times of the day and night. Weather conditions that have spawned the greatest number of tornadoes occur between April and June. Of the total number 82 percent occur between noon and midnight (during the warmest hours of the day). The greatest single concentration of tornadoes during this period takes place between 4:00 p.m. and 6:00 p.m.

The chance that a specific location will be struck by a tornado in any one year is quite small. However, this should not lead one to feel secure and complacent with regard to the danger a tornado poses to a particular area. Exceptions to this rule do take place and, those who lived in Oklahoma City, Oklahoma; Baldwyn, Mississippi; or Codell, Kansas; during certain years prior to now, are aware of this. Oklahoma City has been struck by tornadoes 26 times since 1892, and Codell, Kansas, was struck on the same date, May 20, in three consecutive years, 1916, 1917, and 1918. People living in that city must surely have come to see the exception as the rule. A number of other cities have had the experience of being struck by more than one tornado on a particular day. Irving, Kansas, was one-third destroyed by two tornadoes 45 minutes apart on May 30, 1879, and Austin, Texas, had two tornadoes in rapid succession on May 4, 1922. Twin funnels are shown in visual 8. This was taken on Palm Sunday, 1965. Thus,

Number of Tornadoes, Tornado Days, and Resulting Losses by Years, 1916-1970—from *Climatological Data, National Summary*, 1971 (page 55), NOAA, Environmental Data Service.

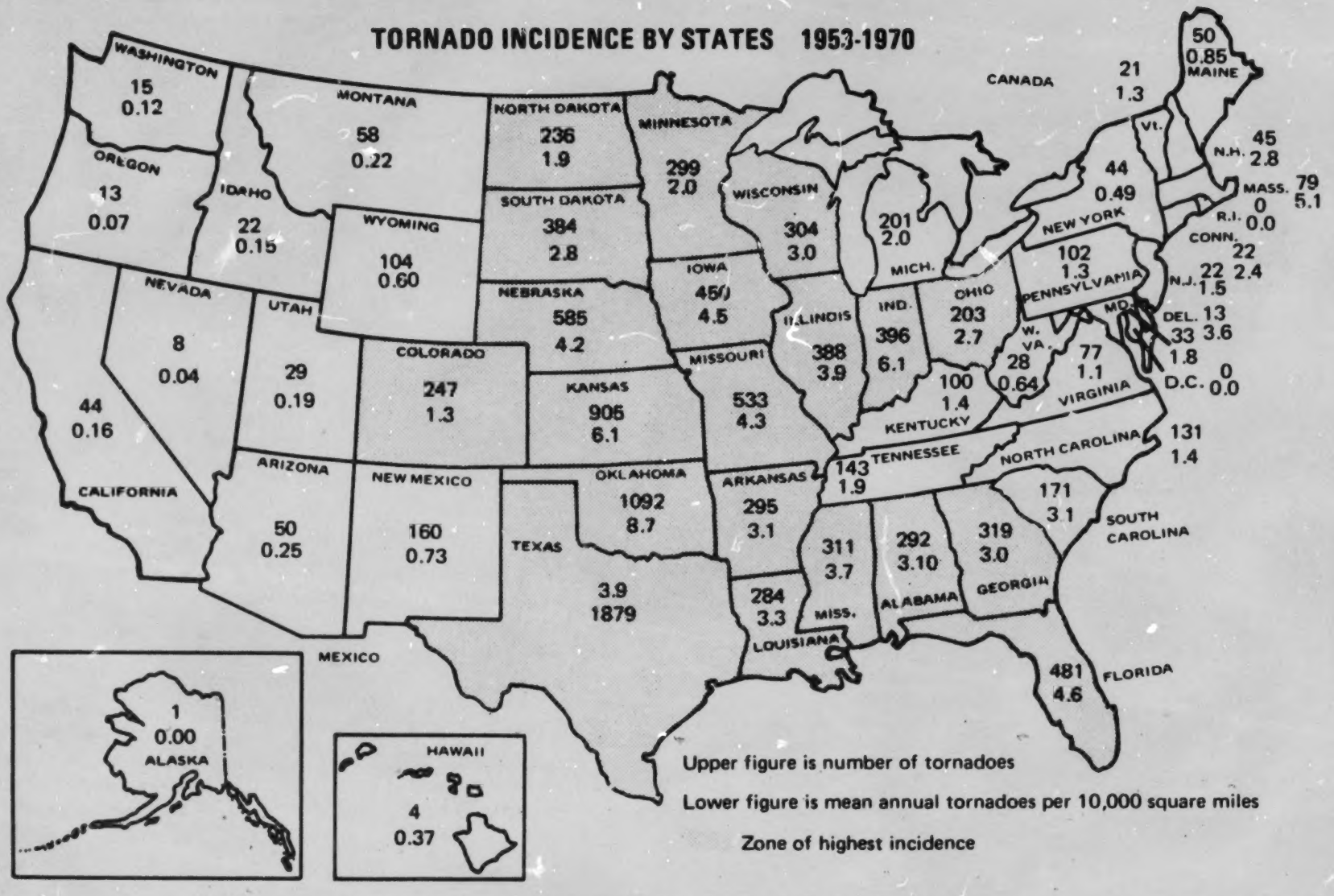
YEAR	Number tornadoes	Number Tornado days	Total Deaths	Most deaths in a single tornado	Total property losses †	Number of tornadoes causing losses † in		
						category 5	category 6	category 7 & over
1916	90	36	150	30	6	7	1	0
1917	121	38	509	101	7	21	9	0
1918	81	45	135	36	7	20	5	0
1919	64	35	206	59	7	10	2	0
1920	87	50	498	87	7	14	10	0
1921	105	55	202	61	7	22	3	0
1922	108	64	135	16	7	27	5	0
1923	102	59	109	23	6	21	1	0
1924	130	57	376	85	7	26	11	1
1925	119	65	794	689	7	34	2	1
1926	111	57	144	23	6	28	0	0
1927	163	62	540	92	7	42	9	1
1928	203	79	92	14	7	40	7	0
1929	197	74	274	40	7	48	4	0
1930	192	72	179	41	7	38	6	0
1931	94	57	36	6	6	14	1	0
1932	151	67	394	37	7	23	1	1
1933	258	96	362	34	7	46	9	0
1934	147	77	47	6	6	10	3	0
1935	180	77	70	11	6	29	0	0
1936	151	71	552	216	7	17	5	1
1937	147	75	29	5	6	24	0	0
1938	215	76	183	32	7	29	6	0
1939	152	75	87	27	7	21	3	0
1940	124	62	65	18	7	13	2	0
1941	118	57	53	25	6	24	1	0
1942	167	66	384	65	7	42	10	0
1943	152	61	58	5	7	28	8	0
1944	169	68	275	100	7	50	9	0
1945	121	66	210	69	7	21	10	1
1946	106	65	78	15	7	29	7	0
1947	165	78	313	169	7	46	7	1
1948	183	68	140	33	7	62	11	2
1949	249	80	212	58	7	54	13	0
1950	199	88	70	18	7	47	9	0
1951	272	113	34	6	7	35	11	2
1952	236	98	230	57	7	53	19	0
1953	437	136	516	116	8	63	18	7
1954	549	159	35	6	7	63	8	1
1955	593	153	125	80	7	74	13	1
1956	532	155	83	25	7	83	24	1
1957	864	154	191	44	8	129	26	3
1958	565	166	66	19	7	70	8	1
1959	589	156	58	21	7	70	4	1
1960	618	172	47	16	7	65	11	1
1961	682	169	51	16	7	103	21	1
1962	658	152	28	17	7	51	10	0
1963	461	141	31	5	7	77	15	1
1964	713	156	73	22	7	113	17	5
1965	899	181	298	44	8	126	30	11
1966	570	150	99	58	8	79	13	4
1967	912	173	116	33	8	125	33	8
1968	661	171	131	34	8	82	26	6
1969	604	155	66	32	8	98	16	3
1970	649	171	73	26	8	97	24	6
Means: 1953-70	642	159	116	--	-	87	18	3

NOTE: -- The above estimated losses are based on values at time of occurrence.

† Storm damages in categories:

5. $50,000 to $500,000
6. $500,000 to $5,000,000
7. $5,000,000 to $50,000,000
8. $50,000,000 and over.

Visual 6



Tornado Incidence by States (1953-1970)—National Weather Service (updated).

we might conclude that although the United States is a vast area of land and experiences a small number of tornadoes per year in comparison to its size, tornadoes still strike, still destroy, and thus still remain a serious threat to life and property.

Tornadoes differ significantly from most other types of weather-caused disasters in that the time required for their formation and the time during which they cause destruction are very short. The series of pictures in visual 9 shows the formation of a tornado. No other weather disaster strikes with such suddenness. Thus, we can readily see the need for a quick response to the dangers of a tornado, both with respect to the time available for warning the people, and the actions of people to secure immediate shelter from the tornado. Hurricanes and floods, because they are relatively slow in developing and give many natural warning signals that can be observed by a weather expert, offer some time for escape from their effects. By contrast the suddenness and the erratic path of the tornado seldom affords opportunities for evacuation. Under these conditions people must have the necessary knowledge of how tornadoes are formed, how they act, and what steps to take to provide protection for themselves and their families. These "safety rules" have been established as the best possible actions you can take to protect yourself from the destructive force of a tornado.

Tornado Safety Rules

Seek inside shelter, preferably in a tornado cellar, underground excavation, or a steelframed or reinforced concrete building of substantial construction. STAY AWAY FROM WINDOWS!!

<u>In Cities or Towns:</u>

In office buildings -- sit in an interior hallway on a lower floor, preferably in the basement.

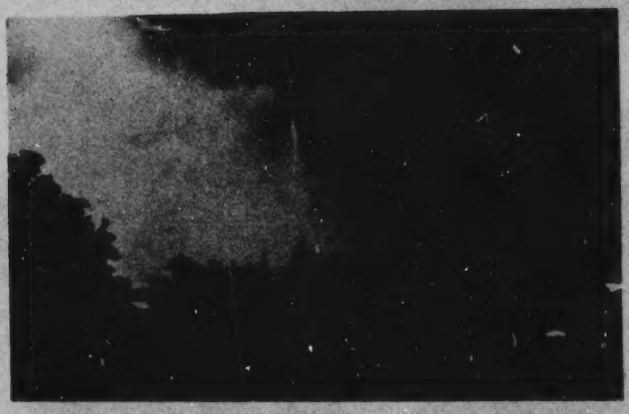
In factories -- on receiving a tornado warning, post a lookout. Workers should move quickly to the section of the plant offering the greatest protection in accordance with advance plans.

In homes -- The basement usually offers the greatest safety. Seek shelter under a sturdy workbench or heavy table if possible. In a home with no basement, take cover under heavy furniture in the center part of the house. Keep some windows open, but stay away from them!

Mobile homes are particularly vulnerable to being overturned during strong winds. Mobile home parks should have a community shelter (visual 10).

Persons in mobile homes should seek shelter in the nearest permanent building. They should appoint a community leader

Visual 8



Visual 9

responsible for constant radio monitoring during threatening weather or during watch periods.

In Schools:

Go to the designated tornado shelter area or, if one has not been designated, go to an interior hallway on the lowest floor; AVOID AUDITORIUMS AND GYMNASIUMS or other structures with wide, freespan roofs.

If a building is not of reinforced construction, go quickly to a nearby reinforced building, or to a ravine or open ditch and lie flat.

In Open Country:

Move away from the tornado's path at a right angle. If there is no time to escape, lie flat in the nearest depression, such as a ditch or ravine.

REMEMBER

TORNADO WATCH means tornadoes are expected to develop!
TORNADO WARNING means a tornado has actually been sighted!

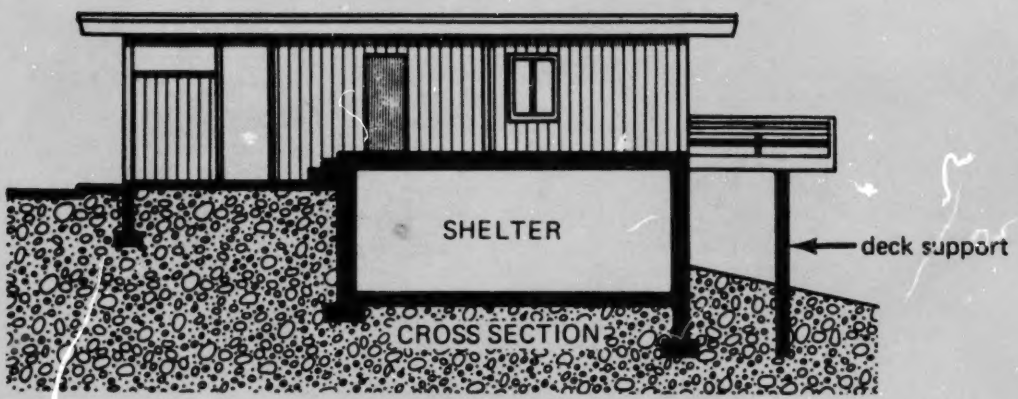
KEEP LISTENING

Your radio and television stations will broadcast the latest tornado advisory information. Call the National Weather Service only to report a tornado.

This is not to say that protection from a tornado is solely the job of the individual. Efforts should be and are being made at many levels to provide as much protection as possible for each person. The individual and his family should be aware of what actions they should take to survive prior to, during, and after a tornado. Plans should be formulated on the school level. The local, city, and county governments are responsible for developing tornado disaster plans for the community. Local, state, and federal disaster preparedness organizations serve as major contributors to the development of these plans. These levels of government also respond to the disaster once it has taken place. Much of their effort is being directed in the area of prediction and warning programs.

Prediction and Protection: It is not possible to predict exactly where and when severe thunderstorms and tornadoes will occur. It is possible, however, to predict general areas where such a storm could occur. This is done through study of the weather conditions existing in that area at a given moment. This important function is performed by the National Severe Storms Forecast Center (NSSFC) in Kansas City, Missouri. Meteorologists monitor atmospheric conditions throughout the North American Continent using radar, sounding balloons, reports from airplane pilots, and satellite collected data.

Mobile Home Park Community Shelter



DUAL-USE CAPABILITY

- **SEVERE WIND SHELTER**
- **FALLOUT SHELTER**
- **SOCIAL HALL**
- **RESIDENCE**

From the information obtained from all these sources, weathermen determine the area most likely to experience severe storms or tornadoes. Upon establishing the fact that such an area exists, the NSSFC will inform the National Weather Service. The National Weather Service will then inform the public through radio and television stations and civil defense organizations that the possibility exists for a tornado to occur. Such a procedure is called a "TORNADO WATCH." A tornado watch does not mean that a tornado has occurred, is occurring, or will occur. It simply means that the weather conditions are such that a tornado might occur and the people living in that area should be aware of this fact and make some plans to seek shelter should a tornado develop. A "watch" simply means just what it says, "watch for a tornado."

When the National Weather Service receives word that a tornado has actually been sighted, a "TORNADO WARNING" is issued. This warning is conveyed to the public again by the media of communication, television and radio, and by local siren systems if they are available. Such "warnings" tell the people that a tornado has been sighted in their area and to seek shelter immediately. Does your school have a warning signal or system?

To illustrate the job being done by the National Weather Service and its Skywarn Network, it should be noted that since the establishment of that system in 1953, the number of deaths caused by tornadoes in the United States has declined by 42 percent. Furthermore, even though the population in tornado-prone areas has increased by more than 27 percent since 1953, there are indications that, when a tornado strikes one of these populated areas, the loss of life tends to be moderate. This has been attributed to improved warning and more effective precautionary measures.

One of the prime requirements of the National Weather Service in providing adequate warning against tornadoes is to have citizen volunteers. Their purpose is the visual sighting of tornadoes and then informing the local civil defense office or National Weather Service Office. Project SKYWARN was established in January, 1969, and is composed of a network of volunteer observers with communications whose function is to watch for and report any tornado they sight to the National Weather Service or local civil defense office. The National Weather Service in turn will plot the path of the storm and observe it on radar in order to predict the direction and rate of movement and to determine where the need for immediate warning exists. However, this particular program has its limitations. Often the observation of tornadoes by the volunteer observer or spotter is hindered by many factors: darkness, rainfall, man-made structures (buildings, towers, etc.) or the terrain. Consequently, their sightings may not provide enough time to give adequate warning. The effectiveness of the Skywarn Network has been demonstrated sufficiently, however, to make the program desirable.

Coastal areas are subjected to tornadoes formed over water.

When a tornado touches the water, a waterspout is formed (visual 11). Instead of dust and debris in the funnel, water in the form of a spray is present. The same precautions should be observed as for other tornadoes. Fair weather waterspouts resemble their tornado cousins, but appear to develop at the surface and rise into the air.

Lightning

Weapon of the Gods? Lightning has always been a mystery to man. Primitive man gave it many supernatural properties. It was viewed by ancient man as a weapon used by the mythological gods against those who displeased them. According to Greek Mythology the god Thor used his forge to make lightning bolts for Zeus, the god of gods.

This may seem ridiculous to our scientific and technologically oriented minds today, but people are still not completely free from myths regarding lightning. Your parents might be able to tell you how their parents used to make them get into bed and remain absolutely quiet during a lightning storm. Lightning was said to be attracted to loud noises. Many people believe that if you have a pet cat, you should put it out of the house. Their reasoning -- the cat's fur would attract lightning and if the cat were inside the house, the lightning might strike.

Lightning Is Dangerous. We hear of hurricanes, floods, and tornadoes because of the vastness of the damage caused by these storms. Lightning as a disaster does not compare with them. It does, however, cause severe loss of life when seen as a yearly total. In fact, more people are killed on the average by lightning each year than lose their lives due to tornadoes and hurricanes. According to data assembled by the National Center for Health Statistics in the period 1959-1965 deaths in the United States due to lightning averaged almost 150 per year. Another 250 persons were injured each year. Over $100 million in property damage was suffered. Persons struck by lightning receive a severe electrical shock or burns or both. Though proper first aid and artificial respiration can sometimes revive lightning victims, it is usually fatal. This is because of the intensity of the energy in the lightning bolt. Thus, we can see that as a threat to the safety of man, lightning should be a major concern for each of us. This fact is made even more relevant when we consider the frequency with which lightning occurs throughout the world. It is estimated that at any given moment more than 1,800 lightning producing thunderstorms are in progress over the earth's surface. Many people will lose their lives during these thunderstorms.

What Is Lightning? Lightning is a release of energy produced by a discharge of atmospheric electricity. This discharge may occur within a cloud, between clouds, or between the cloud and the ground. It is this last form of lightning that poses

Visual 11

Visual 12

Visual 13

the greatest threat to life and limb. On a very, very minor scale you probably have produced your own lightning. Have you ever walked across a certain type of rug or carpet and reached out to touch something? A flash of light and some pain usually results. That would be similar to what happens when lightning occurs.

If the lightning is powerful enough, it produces a distinct crackling, an almost explosive sound called thunder. Thunder is the result of the expansion of air heated by the high intensity of the lightning stroke. Thunder can provide you with a means of performing some scientific measuring. It can tell you approximately how far away the lightning flash was from you. The distance in miles to the lightning can be estimated by counting the number of seconds between the lightning flash and the resulting thunder and dividing that number by five. Thus, if you see a stroke of lightning in the sky (visual 12) and count to ten before you hear the thunder, the flash of lightning was approximately two miles away. If, however, the thunder and lightning occur almost at the same instance and if you are standing in the open, do not wait to count the next one. You might find yourself in the hospital or even worse. Seek cover, but not under a tree!

How To Protect Yourself. Take time to learn the following safety rules. They offer the best advice available for protecting yourself from the dangers of lightning.

Lightning Safety Rules

These safety rules will help you save your life when lightning threatens.

1. Stay indoors, and do not venture outside unless absolutely necessary.

2. Stay away from open doors and windows, fireplaces, radiators, stoves, metal pipes, sinks, and plug-in electrical appliances.

3. Do not use plug-in electrical equipment like hair dryers, electric tooth brushes, or electric razors during the storm.

4. Do not use the telephone during the storm -- lightning may strike the telephone lines outside.

5. Do not take laundry off the clothesline.

6. Do not work on fences, telephones, power lines, pipelines, or structural steel fabrication.

7. Do not use metal objects like fishing rods and golf clubs. Golfers wearing cleated shoes are particularly good lightning rods.

8. Do not handle flammable materials in open containers.

9. Stop tractor work, especially when the tractor is pulling metal equipment, and dismount. Tractors and other implements in metallic contact with the ground are often struck by lightning.

10. Get out of the water and off small boats.

11. Stay in your automobile if you are traveling. Automobiles offer excellent lightning protection (not wind protection).

12. Seek shelter in buildings. If no buildings are available, your best protection is a cave, ditch, canyon, or under head-high clumps of trees in open forest glades.

13. When there is no shelter, avoid the highest object in the area. If only isolated trees are nearby, your best protection is to crouch in the open, keeping twice as far away from isolated trees as the trees are high.

14. Avoid hilltops, open spaces, wire fences, metal clothslines, exposed sheds, and any electrically conductive elevated objects.

15. When you feel the electrical charge -- if your hair stands on end or your skin tingles -- lightning may be about to strike you. Drop to the ground immediately.

Hail

Hail is a form of precipitation falling from a thunderstorm. The presence of hail indicates extreme turbulence in the thunderstorm. Successive layers of water freeze and add to the size of the original hailstone. Records indicate that hailstones may reach the size of baseballs or larger (visual 13). Hailstones of this size can damage property and cause injury to people and livestock. The economic loss can be substantial.

Hurricanes

What Are Hurricanes? Hurricanes are tropical storms that have their beginnings near the equator. They form over all the tropical oceans except the South Atlantic. Hurricanes are known by several names throughout the world. In Southeast Asia they are called typhoons; in the subcontinent area of India they are called cyclones; and in our Western Hemisphere they are called hurricanes. They form over tropical oceans where there is an abundance of moisture in the warm air. The Atlantic Ocean, the Carribbean, and the Gulf of Mexico are the birthplaces of most of the hurricanes that affect the United States.

The path of the hurricane is usually toward the west at

first and then it curves gradually toward the north. They usually weaken and dissipate before traveling far inland. They can cause severe inland floods because of the heavy rains associated with them. The hurricane is the most powerful of all storms. The disturbance must have a wind velocity of 74 miles an hour or more before it is called a hurricane. Hurricane Camille's winds were in excess of 200 miles per hour. The diameter of the hurricane is usually 50 to 75 miles but in many instances it is greater, sometimes reaching out to 500 miles. The hurricane may carry its destructive power over a path hundreds or even thousands of miles.

The Danger of Hurricanes. Property damage and loss of life from hurricanes have been tremendous (visual 14). This is due to the strong winds and high water with losses from water damage being far greater. Hurricane winds are strong enough to demolish houses, uproot trees, and fill the air with debris (visuals 15 and 16). Even though hurricanes produce much destruction and even though they are the most powerful of storms, we have the greatest amount of protection from them. This is due to the nature of the storm itself. They are predictable. They move at a speed of eight to twelve miles an hour. This slow movement enables us to watch, predict, plan, and implement protective measures. Radar observations show the exact position of the hurricane. This allows civil preparedness planners time to act (visual 17).

People who live in coastal areas of the nation are more hurricane oriented, but all sections could be affected by a hurricane. Damaging winds and high tides cause tremendous destruction in coastal areas. However, tornadoes that are often generated by hurricanes and the heavy rainfall that precedes and follows the hurricane can cause considerable damage as well.

Over the years the number of lives lost during hurricanes has decreased (visual 18). This progress may be due to more knowledge of the nature of the hurricane and the advancement of technology. We are better able to locate and follow its path, warn people, and implement plans for the protection of life.

Damage to fixed property, however, continues to mount as areas affected by hurricanes continue to undergo further economic development (visual 19). (Most of the death and destruction associated with hurricanes is caused by wind, by flood-producing rains, and by storm surges.) Damage from winds is the most severe along the coastline. Once the hurricane reaches land, its strength rapidly weakens. Most newer buildings along the Gulf Coast are designed to withstand hurricane force winds. Most of the deaths and injuries from effects of wind come as a result of flying debris and collapsing buildings.

More deaths and destruction are caused by storm surges than by winds. The boat in visual 20 was carried over 100 yards inland by storm surges and set to rest in the front yard of the house. Hurricanes cause extremely high tides and literally carry

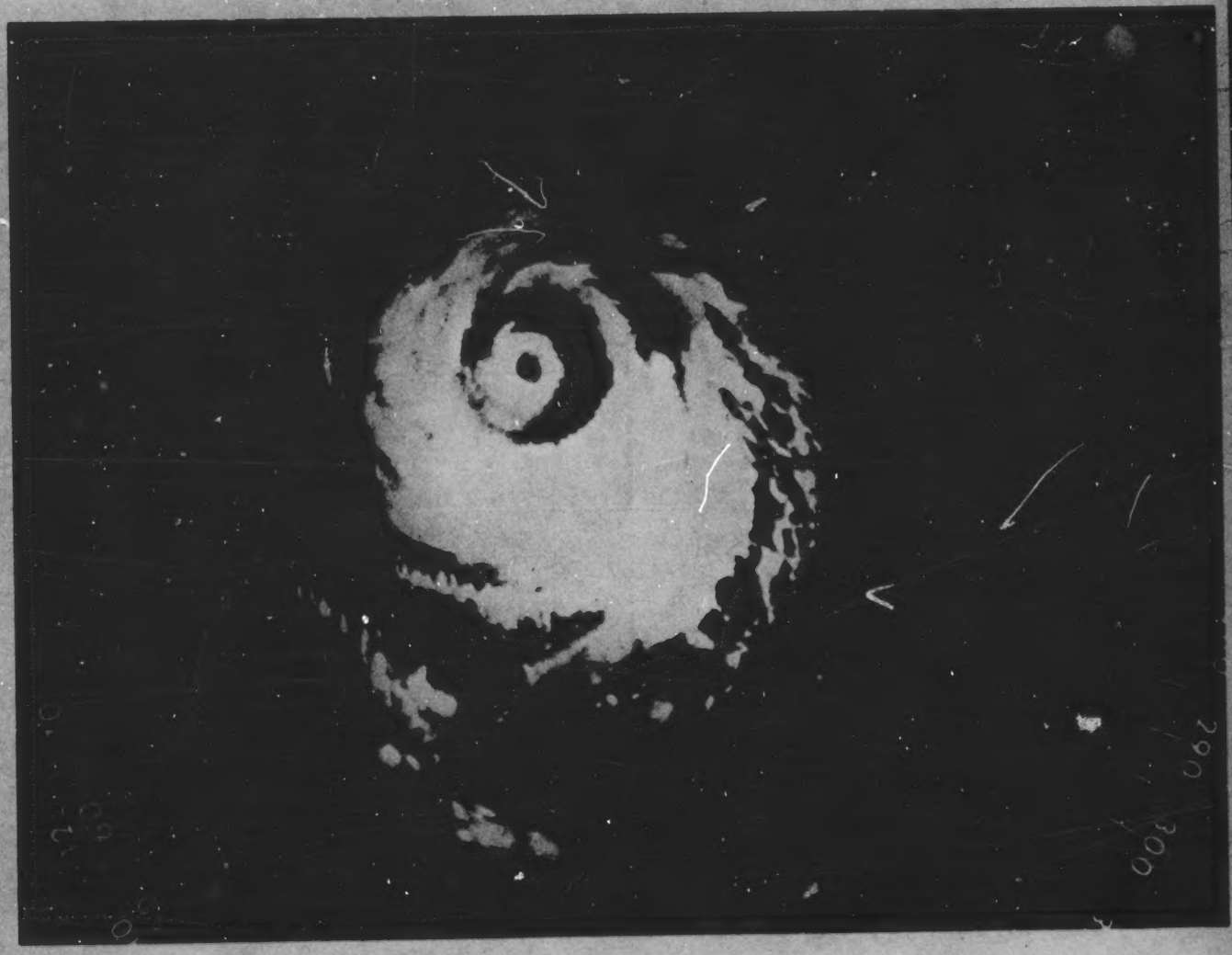
Estimated Loss of Life and Damage in the United States from North Atlantic Tropical Cyclones, 1915-1970 (damage estimates as of year of occurrence)—casualty figures from *Climatological Data, National Summary, 1971* (p. 68), U.S. Department of Commerce, NOAA; damage estimates updated from *Nationwide Natural Disaster Warning System* (p. 27), U.S. Department of Commerce, 1965.

Year	Lives Lost	Damage in million $	Year	Lives Lost	Damage in million $
1915	600	63.0	1943	16	16.8
1916	107	33.3	1944	64	165.0
1917	5	0.2	1945	7	80.1
1918	34	5.0	1946	0	5.2
1919	287	22.0	1947	53	135.8
1920	2	3.0	1948	3	18.4
1921	5	3.0	1949	4	58.8
1922	0	0	1950	19	35.9
1923	0	Minor	1951	0	2.0
1924	2	Minor	1952	3	2.8
1925	6	Minor	1953	2	6.2
1926	269	106.5	1954	193	755.5
1927	0	0	1955	218	984.5
1928	1,836	25.0	1956	21	26.5
1929	3	0.7	1957	395	152.1
1930	0	Minor	1958	2	11.2
1931	0	0	1959	24	23.1
1932	0	0	1960	65	370.4
1933	63	46.7	1961	46	331.0
1934	17	4.8	1962	4	1.1
1935	414	11.5	1963	10	13.0
1936	9	2.3	1964	49	515.2
1937	0	Minor	1965	75	1,446.0
1938	600	300.2	1966	54	15.0
1939	3	Minor	1967	18	200.0
1940	51	4.7	1968	9	10.0
1941	10	7.7	1969	256	1,420.0
1942	8	27.1	1970	11	454.0
			Total	5,953	7,922.3

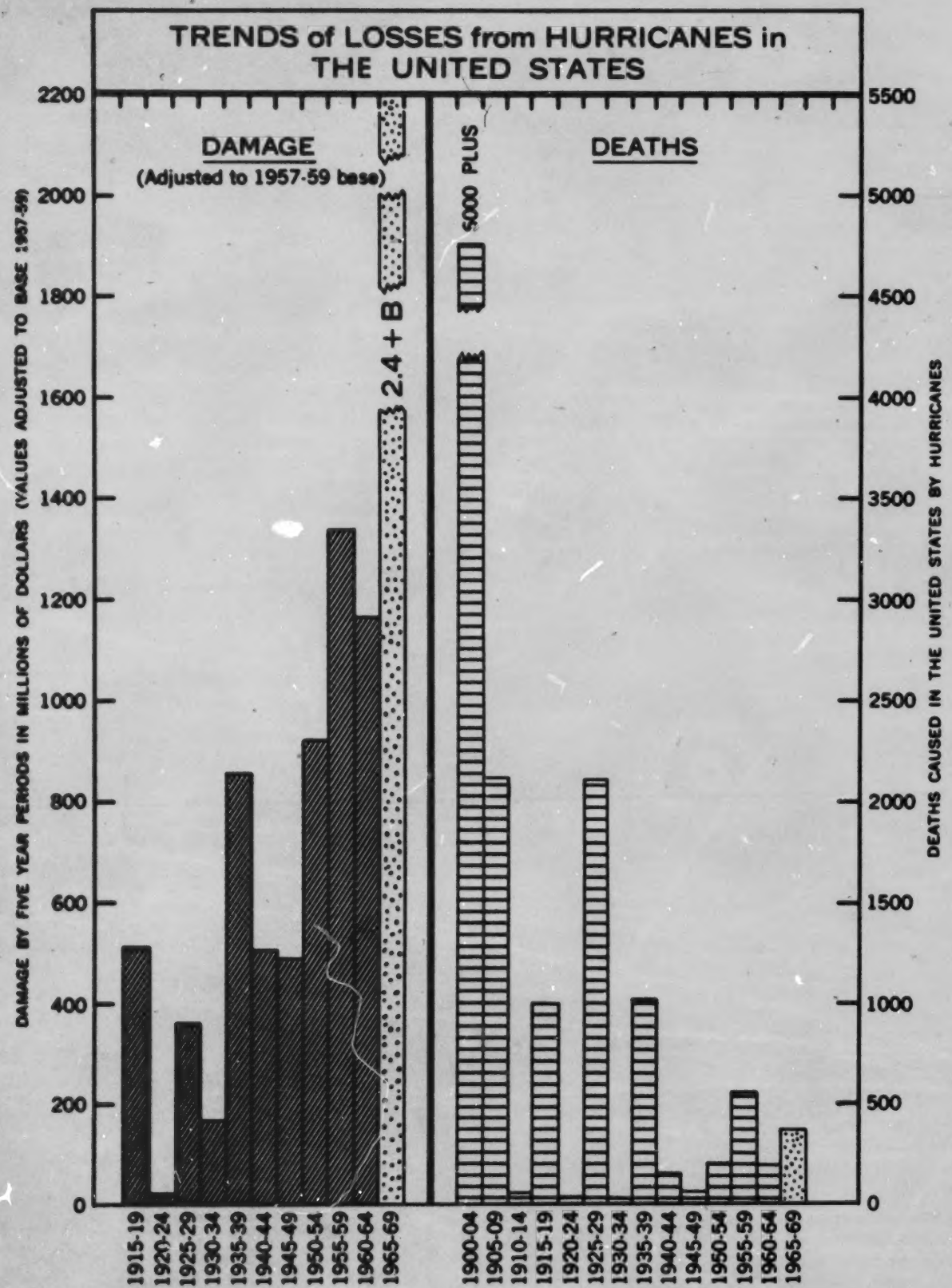
Visual 14

Visual 15

Visual 16



Visual 17



Hurricane Damage and Deaths – from *Project Stormfury–1970*, U.S. Department of Commerce, 1970.

Visual 18

21

Visual 19

Visual 20
22

walls of water into low areas. These walls of water and their receding currents cause tremendous amounts of property damage and many deaths. Some good examples of this can be drawn from the hurricane that hit Galveston, Texas, in 1900. Some 6,000 people died directly as a result of the storm surges. Another 2,000 people drowned in Florida with the hurricane of 1928 when the waters of Lake Okeechobee were literally blown out of the lake and forced into the nearby countryside. Another 380 people drowned when Hurricane Audry struck the Louisiana coast in June of 1957. Floods produced by hurricane rainfall usually are more destructive than the winds of the hurricane. The typical hurricane in just a few hours brings from six to twelve inches of rainfall into the area that it crosses. The resulting floods produce great damage and loss of life, especially in valley areas that are surrounded by the more hilly mountainous regions. The winds from Hurricane Diane in 1955, for example, caused little damage as it moved inland. Long after the winds had subsided, floods produced by rainfall in Pennsylvania, New York, and New England killed 200 people and caused an estimated $700 million in damage (visual 21).

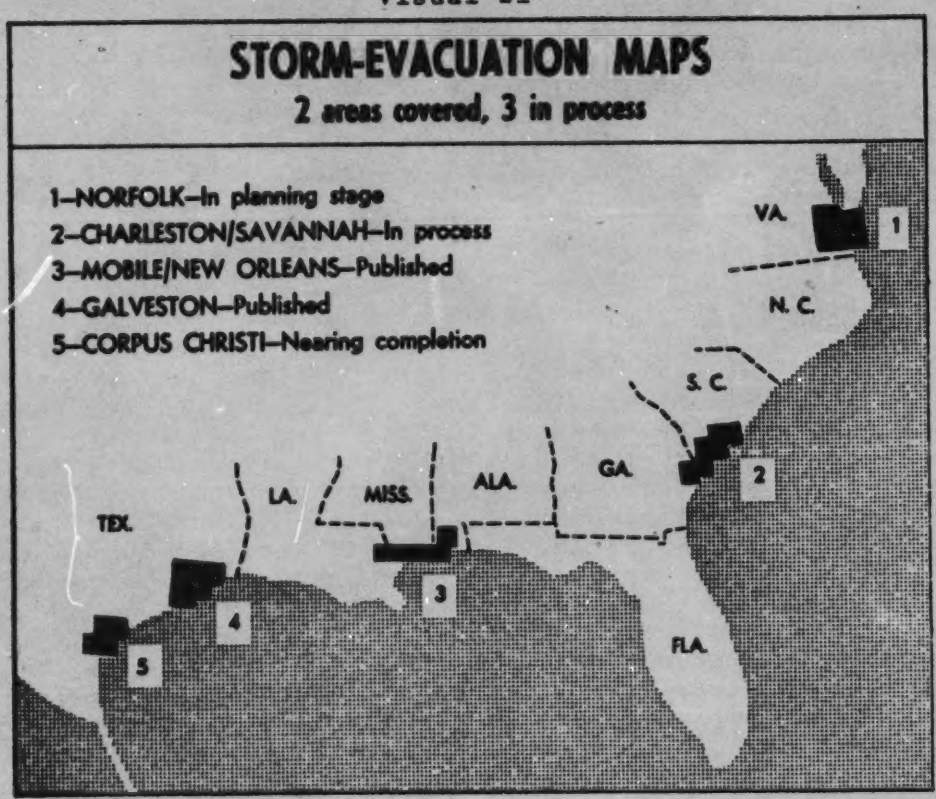
A more recent example was Hurricane Camille in 1969. Two days after this severe storm had wrecked the Louisiana-Mississippi coastline, record-breaking amounts of rain fell in the mountains of West Virginia. The resulting flash floods claimed over 100 lives and caused more than $100 million in property damage.

June, 1972, offers one of the best examples of how a hurricane can affect areas of the country other than the coastline. After striking the Gulf Coast, Hurricane Agnes produced heavy rains along the entire eastern seaboard. Pennsylvania, New York, Maryland, Virginia, Delaware, New Jersey, and North Carolina were all bombarded by the torrential rains and flooding. The result -- more than 111 people dead, many more missing, hundreds of thousands of people left homeless, and many millions of dollars in property damage.

Predicting Hurricanes. There is no excuse for people in coastal areas to be victims of hurricanes. The National Weather Service offers the best protective measures and best warning systems for any of the major disasters. The Hurricane Forecasting Service of the National Weather Service keeps a constant watch of coastal waters for any type of weather condition that indicates a hurricane forming. Hurricane forecasting branches are located in Miami, Florida; Washington, D. C.; Boston, Massachusetts; New Orleans, Louisiana; San Francisco, California; Honolulu, Hawaii; and San Juan, Puerto Rico.

Satellites, aircraft, and radar act as the artificial eyes of these centers. From a vantage point 22,300 miles above the earth, United States weather satellites enable us to spot seedling storms as soon as they form. As the storms move closer to shore, reconnaissance aircraft are launched to get a first-hand

Visual 21



Visual 22

look at what is developing. There are 17 such hurricane planes, all stationed at Miami, Florida. When the storms are within 250 miles of our shore, they move into range of some 17 coastal radar stations. With such observations it is possible to predict where a storm is heading and how dangerous it is. Thanks to our computer age we are also able to predict the height of the storm surges (tide) that will be produced by the storm. This enables us to determine which areas need definite education if lives are to be saved. It has been estimated that 90 percent of the hurricane victims die by drowning in tidal storm surges.

Also available for use by local government planners are certain storm-evacuation maps. These maps show areas that will be inundated by various levels of tide and the best routes for evacuation inland. Maps are now available for a strip from Mobile, Alabama, to New Orleans, Louisiana, hard hit by Hurricane Camille, and the Galveston, Texas, area, which at the turn of the century experienced the worst hurricane disaster in United States history (visual 22). Additional maps are being prepared for other areas subjected to hurricane disasters.

As soon as a hurricane is spotted, an advisory is sent to all National Weather Service Offices, giving the location, the direction of travel, the rate of movement, and the wind velocity of the storm. This report is given every six hours even though the storm may be far from our shores. When the storm approaches the coast and is within 24 to 36 hours away, a "HURRICANE WATCH" is announced. A "HURRICANE WATCH" does not necessarily mean a hurricane is coming to a particular area. It simply means that offshore, 24 to 36 hours away, there is a storm that could pose a threat to the area for which the watch has been issued.

If a "HURRICANE WARNING" is announced, this means that the winds in the storm have reached hurricane force (74 miles per hour or more) and are expected to move into the area within 24 hours. "WARNINGS" are usually issued in the hope of providing people with at least 12 hours of daylight to take protective actions and plan for evacuation. Sometimes, however, the behavior of a hurricane is so erratic that "WARNINGS" may be issued only a few hours prior to the hurricane's striking.

When a "HURRICANE WATCH" is issued, you should listen attentively and diligently to weather bulletins. When you receive a "HURRICANE WARNING," you should follow all instructions issued by both the National Weather Service and local government agencies with regard to what actions you need to take to protect yourself.

<u>What Must You Do To Survive?</u> Knowing when to do something can offer little protection if you do not also know what to do. The best possible action you can take if your area is threatened by a hurricane, is to evacuate that area. Even then there are many things that you would have to do in order to protect your

property (board up windows, store trash cans, etc.) as much as possible from the severe effects of the storm while you are safely evacuated out of the area.

Should you, for some unforeseeable reason, be caught in the hurricane, these actions become even more important for now you are not only trying to protect your property, but you are also trying to protect yourself. The following "safety rules" are intended to offer each individual the most desirable action he can take in order to have the best chance for surviving a hurricane.

If you talked with the people who have survived such hurricanes as Betsy, Beulah, Camille, or Carla, the importance of these rules could be easily understood. You cannot stick your head in the sand and expect some organization or government agency to save your life. You must act correctly if you are to survive.

Hurricane Safety Rules

Before

1. Enter each hurricane season prepared. Every June through November, recheck your supply of boards, tools, batteries, non-perishable foods, and the other equipment you might need if a hurricane strikes your town.

2. When you hear the first tropical cyclone advisory, listen for future messages. This will prepare you for a hurricane emergency well in advance of the issuance of watches and warnings.

3. When your area is covered by a hurricane watch, continue normal activities but stay tuned to radio or television for all National Weather Service advisories. If the danger materializes, a hurricane warning will be issued. Meanwhile, keep alert. Ignore rumors.

4. When your area receives a hurricane warning, plan your time before the storm arrives and avoid the last-minute hurry which might leave you marooned or unprepared.

During

1. Keep calm until the emergency has ended.

2. Leave low-lying areas that may be swept by high tides or storm waves.

3. Leave mobile homes for more substantial shelter. They are particularly vulnerable to overturning during strong winds. Damage can be minimized by securing mobile homes with heavy cables anchored in concrete footing.

4. Moor your boat securely before the storm arrives or evacuate it to a designated safe area. When your boat is

moored, leave it, and do not return once the wind and waves are up.

5. Board up windows or protect them with storm shutters or tape. Danger to small windows is mainly from wind-driven debris. Larger windows may be broken by wind pressure.

6. Secure outdoor objects that might be blown away or uprooted. Garbage cans, garden tools, toys, signs, porch furniture, and a number of other harmless items become missiles of destruction in hurricane winds. Anchor them or store them inside before the storm strikes.

Floods

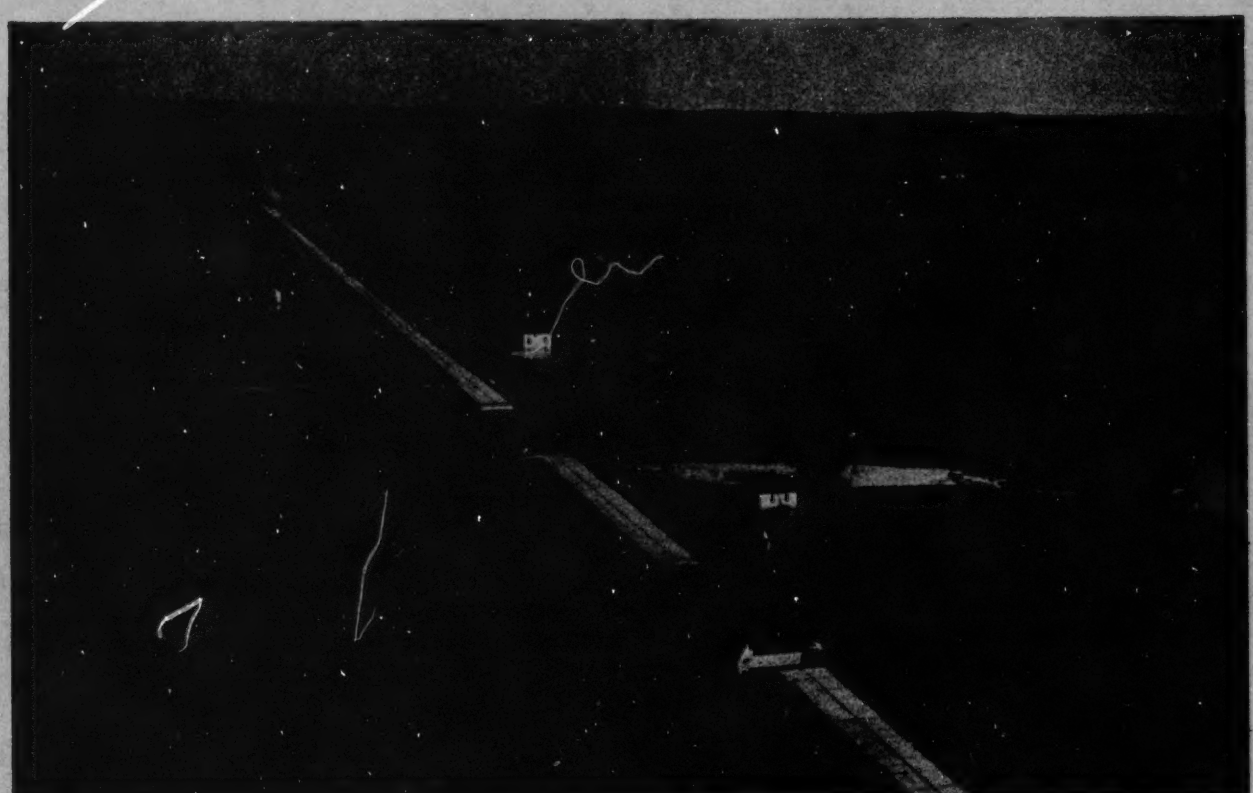
The flooding of land adjoining the normal course of a stream or river has been a natural occurrence since the earth was formed. What makes this flooding a disaster is the occupation of that land by man at the time the flood occurs (visual 23). Usually the best and most fertile land is located along the waterways of a country. This is true not only because this land is of farming value, but because of the natural irrigation the water provides (visual 24). These rivers and streams have afforded the best and most economical means of transportation and communication. Thus, large numbers of people have tended to settle near rivers and subject themselves to floods and their effects. Approximately ten million people live in areas exposed to the direct possibility of flooding. Another 25 million live close enough to flood areas to be affected by them.

As the population has continued to increase, the losses in lives and property from floods have increased (visual 25).

For a 14-year period (1955-1969) the average annual loss of life because of floods in the United States was 83. The losses in property each year have been estimated at from one to two billion dollars. The increase in property damage is due in part to the increase in population and the building of more industrial facilities near the river systems of the United States. It has been estimated that the annual losses by the year 2020 will be five billion dollars.

The immediate danger of floods comes from the force of the currents as water rushes through an area. Many people are drowned and many others are injured by the raging waters and the debris picked up by these currents. Entire sections of towns are often washed away by the swift waters. This general destruction leads to many other dangers to life and property in the affected area. Hunger and disease are major side effects of flood damage. The widespread death of animals and the breaking of sewage lines and pollution of the water supply create a considerable health hazard to the survivors.

Visual 23



Visual 24

Severe River Flood Disasters in the United States, 1935-1966 (loss of life 25 or more), property damage in millions of dollars—from *Climatological Data, National Summary, 1970* (pp. 96-97), NOAA, Environmental Data Service.

Year	Month	Location	Lives	Property
1935	May-July	Republican and Kansas Rivers	110	$ 18.0
	July	Upper Susquehanna	52	26.0
1936	March-April	Eastern United States	107	270.0
1937	Jan.-Feb.	Ohio and Lower Mississippi River Basins	137	417.7
1938	March	Southern California	79	24.5
1939	July	Licking and Kentucky Rivers	78	1.7
1940	August	Southern Virginia and Carolinas, and Eastern Tennessee	40	12.0
1943	April-June	Maumee, Wabash, Upper Mississippi, Missouri, White, and Arkansas River Basins	60	172.0
1947	May-July	Lower Missouri and Middle Mississippi River Basins	29	235.0
1948	May-June	Columbia Basin	35	101.7
1950	June	Central West Virginia	31	4.0
1951	June-July	Kansas-Missouri	28	923.2
1955	August	Hurricane floods in Northeast	187	714.1
	December	West Coast	61	154.5
1963	March	Ohio River Basin	26	97.6
1964	June	Montana	31	54.3
	December	California and Oregon	40	415.8
1965	June	Sanderson, Texas, flash flood	26	2.7
1969	Jan.-Feb.	California	60	399.2
	July	Northern Ohio	30	87.9
	August	James River Basin in Virginia	154	116.0

Visual 25

Controlling Floods. Much work is being done in the area of flood control by governmental and private agencies. More and more dams, levies, and other flood control devices are being built to lessen the possibility of flooding. Land-use studies are used in planning new construction.

A constant weather watch is kept by the National Weather Service. If conditions develop that produce heavy rainfall and flood danger, public officials are advised. People are then advised as to what actions they should take: sandbagging, evacuation, etc., to safeguard their lives and property.

Listed below are flood safety rules, which provide actions for the individual in order to help himself and assist local officials in helping others survive a flood disaster. How well you know these rules and use them is the key to surviving a flood.

Flood Safety Rules

Before the Flood:

1. Keep on hand materials like sandbags, plywood, plastic sheeting, and lumber.

2. Install check valves in building sewer traps to prevent flood water from backing up in sewer drains.

3. Arrange for auxiliary electrical supplies for hospitals and other operations which are critically affected by power failure.

4. Keep first-aid supplies on hand.

5. Keep your automobile fueled; if electrical power is cut off, gasoline stations may not be able to operate pumps for several days.

6. Keep a stock of food which requires little cooking and no refrigeration; electric power may be interrupted.

7. Keep a portable radio, emergency cooking equipment, lights, and flashlights in working order.

When You Receive a Flood Warning:

8. Store drinking water in clean bathtubs and in various containers. Water service may be interrupted.

9. If forced to leave your home and time permits, move essential items to safe ground; fill tanks to keep them from floating away; grease immovable machinery.

10. Move to a safe area before access is cut off by flood

water.

During the Flood:

11. Avoid areas subject to sudden flooding.

12. Do not attempt to cross a flowing stream where water is above your knees.

13. Do not attempt to drive over a flooded road or bridge -- you can be stranded and trapped.

After the Flood:

14. Do not use fresh food that has come in contact with flood waters.

15. Test drinking water for potability; wells should be pumped out and the water tested before drinking.

16. Seek necessary medical care at nearest hospital. Food, clothing, shelter, and first aid are available at Red Cross shelters.

17. Do not visit disaster area; your presence might hamper rescue and other emergency operations.

18. Do not handle live electrical equipment in wet areas; electrical equipment should be checked and dried before returning to service.

19. Use flashlights, not lanterns or torches, to examine buildings; flammables may be inside.

20. Report broken utility lines to appropriate authorities.

In the United States most floods are the result of unusually heavy rainfall during a brief period of time. This leads to established rivers overflowing their banks and flooding the surrounding areas. It also results in flash flooding, because of vast quantities of water pouring down from highland areas into the valleys below. A good example of flash flooding is that which occurred in Virginia and West Virginia because of Hurricane Camille. As the storm front passed over the mountainous area, as much as 27 inches of rain fell within a few hours. The small mountain streams soon became raging torrents, causing considerable destruction as they raced down toward the James River. This caused the James River to flood the area along its path. Many lives were lost as a result.

A more recent example of flooding caused by excessive rainfall over a short period of time occurred on June 9, 1972, in the Black Hills of South Dakota. Rapid City, a resort town in the Black Hills, was very badly damaged and more than 235 people were killed and many more injured. Total damages to homes and businesses in the area rose above $100 million.

Flash Flood Safety Rules

Before the Flood:

1. Know the elevation of your property in relation to nearby streams and waterways.

2. Investigate the flood history of your area.

3. Make advance plans to evacuate by way of a road not subject to flooding.

When a Flash Flood Watch Is Issued:

1. Listen to area radio and television stations for flash flood warnings. Also listen for other locally devised warning signals.

2. Be prepared to move out of danger at a moment's notice by way of a safe route.

When a Flash Flood Warning Is Issued:

1. Act quickly to save yourself.

2. You may have only seconds to act.

3. Move by way of a predetermined route if possible.

4. Avoid already flooded areas.

5. Do not enter flooded roads or bridges unless you know that they have not been destroyed.

6. If your car stalls, abandon it and seek higher ground.

7. Be more cautious at night due to the reduced visibility.

8. Continue to monitor local radio or television stations if possible.

Flooding is a natural expansion of a stream from its established path. This expansion may be sudden as in flash flooding. It may be gradual and extend over many days. The result is always destruction of property and sometimes loss of lives. By observing established safety rules, damage and deaths may be minimized. The average year may have as many as 75,000 people driven from their homes. As many as 90 people may be killed in this average year due to floods. Property damage may reach or exceed $250 million. The impact of flooding is significant and must be dealt with.

Winter and You

The perpendicular rays of the sun shift south of the equator in September. From September to March the polar air masses dominate the majority of the Continental United States. This change in the weather in most sections of the country means a change in the way humans must prepare to cope with their environment.

Intense winter storms may be accompanied by cold waves, ice or glaze, heavy snow, blizzards, or a combination of these. The results of these storms may be total isolation, death to persons and livestock, and serious economic loss to agriculture, utilities, highways, bridges, and individuals (visual 26).

Winter Storms

Blizzards. A blizzard is a winter storm which brings extremely cold weather, strong winds, and blowing snow. During a blizzard, winds will travel at least 35 miles per hour and temperatures may be 20 to 30 degrees below zero. The temperature may be even lower over a period of several days, sometimes falling ten to twenty degrees per hour. A severe blizzard has winds that travel up to 50 or 60 miles per hour with dense hard-driven snow. Ice or glaze and freezing rain are also hazardous conditions associated with winter storms.

Winter storms usually form where there is an abundance of cold air as in the Rocky Mountains and the Plains States of North America. A blizzard is usually produced when outbreaks of cold polar air are drawn into active low pressure disturbances. Winds may blow up to 50 or 60 miles an hour filling the air with fine powdery snow which is driven with such force that deep snowdrifts accumulate often reaching heights in excess of 30 feet. Persons caught outside may find breathing difficult. During such storms shelter should be sought immediately. Many people die each year for failure to find protection fast enough. Ice storms usually cause a sheet of ice on the highway which makes movement very dangerous. Winter storms may cause a high death count of farm animals (visual 27). Plants and crops are usually frozen and destroyed. Conditions favorable to the occurrence of blizzards can be forecast quite accurately.

Many Deaths Have Resulted. Winter storms can kill. Their danger is persistent from year to year. From 1936 through 1969 snowstorms caused more than 3,000 deaths. The greatest number of snow-related deaths,354, occurred in 1960. About half of these occurred in New England, New York, and Pennsylvania. Lands which lie westward from the Great Lakes are most likely to be stricken by blizzards. This area includes North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, and Nebraska. Blizzards may strike anywhere within the Middle West and have been known to hit as far south as Texas and the Great Plains.

Visual 26

Visual 27

Some very destructive ice storms have occurred in the Southern States where neither buildings nor life styles are designed with severe winter conditions in mind. From January 28 to February 4, 1951, the most damaging ice storms in the United States occurred. Some $50 million damage occurred in Mississippi, $15 million in Louisiana, and $2 million in Arkansas. Twenty-two deaths resulted from these storms.

Learning what you should do during these storms is vital to surviving them.

The following safety rules will help you to survive a winter storm. There are many other important tips for your locality. Observe these safety tips for your area and climate.

Winter Storm Safety Rules

General Safety:

1. Keep ahead of the winter storm by listening to the latest weather warnings and bulletins on radio and television.

2. Check battery powered equipment before the storm arises. A portable radio or television set may be your only contact with the world outside.

3. Check your supply of heating fuel. Fuel carriers may not be able to move if a winter storm buries your area in snow.

4. Check your food and stock an extra supply. Include food that requires no cooking or refrigeration in case of power failure.

5. Prevent fire hazards from overheated coal or oil burning stoves, fireplaces, heaters, or furnaces.

6. Dress to fit the season. If you spend much time outdoors, wear loose-fitting, lightweight, warm clothing in several layers; layers can be removed to prevent perspiring and subsequent chill. Outer garments should be tightly woven, water repellent, and hooded. Remember that entrapped, insulating air, warmed by body heat, is the best protection against cold. Layers of protective clothing are more effective and efficient than single layers of thick clothing; mittens, snug at the wrists are better protection than fingered gloves.

7. Make necessary trips for supplies before the storm develops. Arrange for emergency heat supply in case of power failure.

8. Stay indoors during storms and cold snaps unless in peak physical condition. Avoid overexertion.

9. Do not kill yourself shoveling snow. It is extremely hard work, and can bring on a heart attack, a major cause of death during and after winter storms.

When You Travel:

1. During winter storms your automobile can be your best friend -- or worst enemy -- depending on your preparations. Get your car winterized before the storm season begins.

2. Keep water out of your fuel by maintaining a full tank of gasoline.

3. Be equipped for the worst. Carry a winter storm car kit especially if cross-country travel is anticipated or if you live in the Northern States.

4. Plan your travel and select primary and alternate routes.

5. Winter travel by automobile is serious business. Take your travel seriously.

6. If the storm exceeds or even tests your limitations, seek available refuge immediately. It is not safe to remain in the car with the heater on for keeping warm unless there is proper ventilation.

7. Travel in convoy with another vehicle if possible.

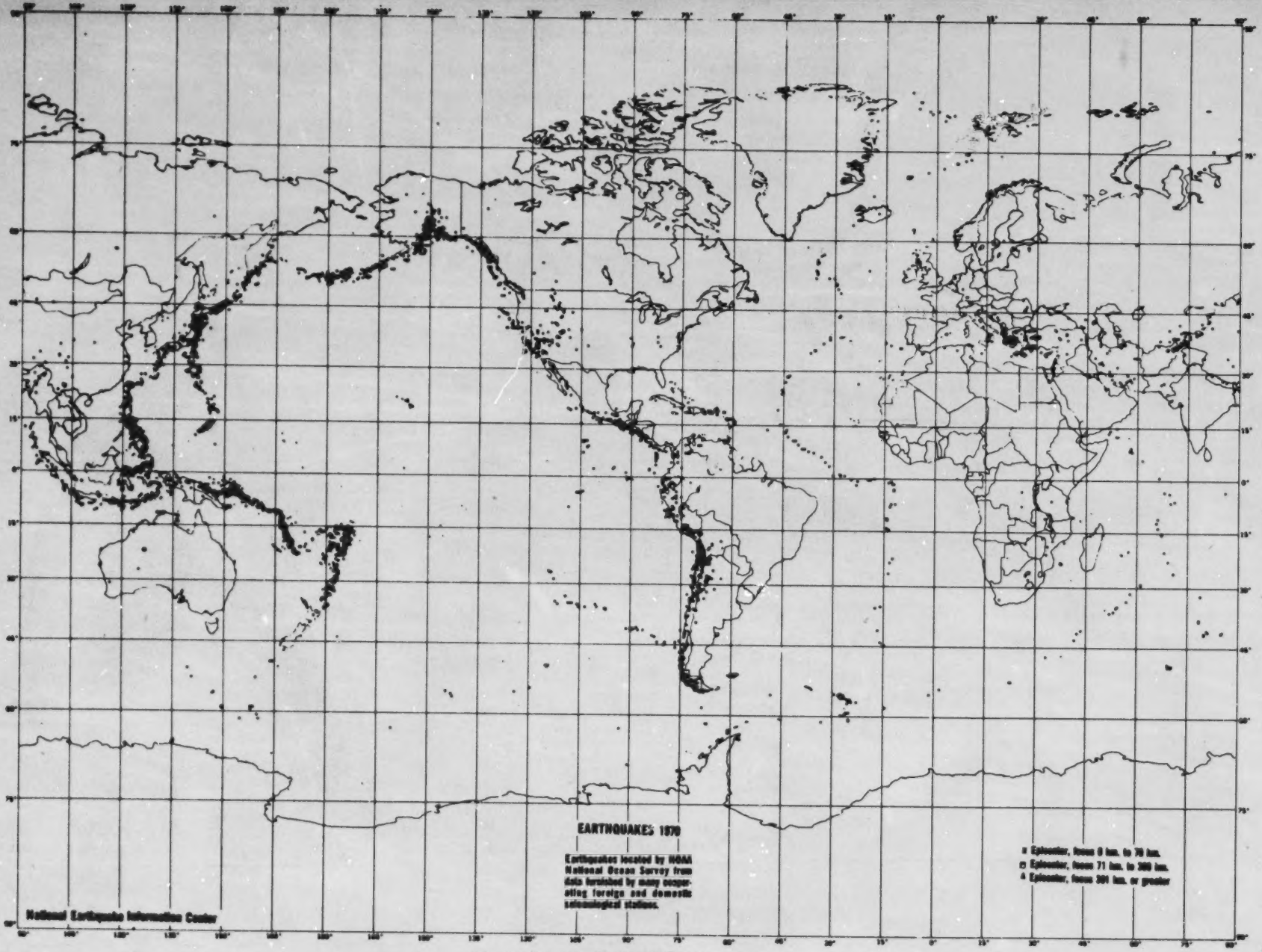
8. Drive carefully, defensively.

By observing established safety rules, winter may pass without your being added to the number of dead and injured. From 1936 through 1969, snowstorms caused more than 3,000 deaths, directly or indirectly. Prior planning can reduce the hazards of severe winter weather.

Earthquakes

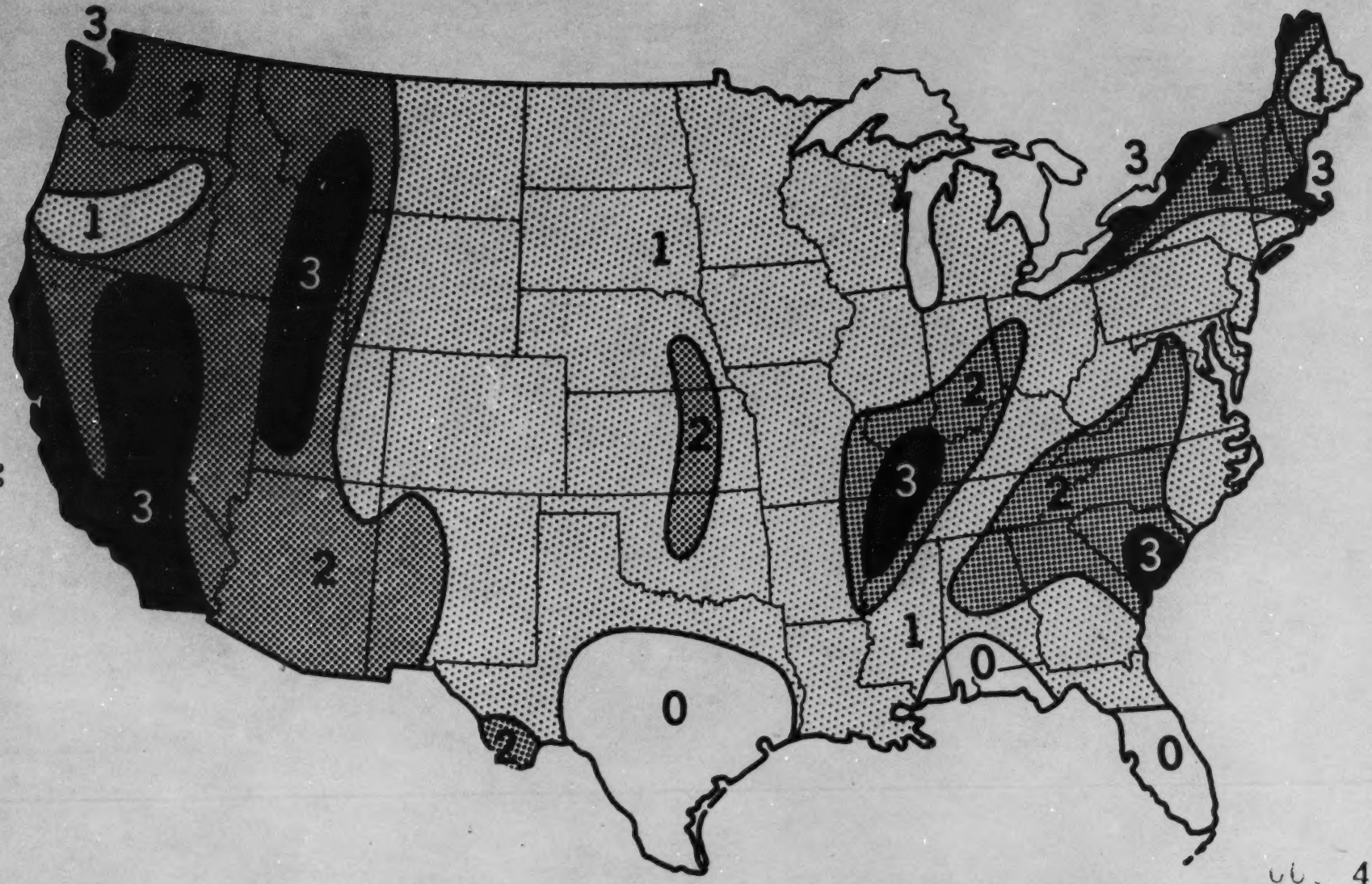
It has been estimated that several million earthquakes occur every year throughout the world. They range from very minor "quakes" that are barely perceptible to earthquakes that are so severe they often destroy entire cities and countrysides with their force. Hundreds of earthquakes occur each year that are capable of causing major damage.

Almost no area of the world is free from the dangers of earthquakes. Those land areas bordering the Pacific Ocean are the most vulnerable (visual 28). The United States is also susceptible to the forces of earthquakes. Areas within California and Alaska are the most likely to be the victims of an earthquake although many other regions within the United States are exposed to the threat of earthquakes (visual 29). The earthquake that struck Prince William Sound, Alaska, in 1964, took 131 lives and resulted in more than $400 million in property damage (visual 30). San Francisco, California, was almost totally demolished by the earthquake and resulting fires that struck that city in 1906. Seven hundred people lost their lives.


EARTHQUAKES 1970
Earthquakes located by NOAA National Ocean Survey from data furnished by many cooperating foreign and domestic seismological stations.
National Earthquake Information Center

World Seismic Belts—NOAA map.

Visual 28



Seismic Risk: Zone 0, areas with no reasonable expectancy of earthquake damage; Zone 1, expected minor damage; Zone 2, expected moderate damage; Zone 3, where major destructive earthquake may occur—NOAA map.

Visual 29

Visual 30

Major Recorded Earthquakes–NOAA.

Year	Locality	Deaths
856	Greece, Corinth	45,000
1038	China, Shansi	23,000
1057	China, Chihli	25,000
1268	Asia Minor, Silicia	60,000
1290	China, Chihli	100,000
1293	Japan, Kamakura	30,000
1531	Portugal, Lisbon	30,000
1556	China, Shansi	830,000
1667	Caucasia, Shemaka	80,000
1693	Italy, Catania	60,000
1737	India, Calcutta	300,000
1755	Northern Persia	40,000
1755	Portugal, Lisbon	60,000
1759	Lebenon, Baalbek	30,000
1783	Italy, Calabria	50,000
1797	Ecuador, Quito	41,000
1811	U.S., New Madrid, Mo.	Several
1819	India, Cutch	1,543
1822	Asia Minor, Aleppo	22,000
1828	Japan, Echigo (Honshu)	30,000
1868	Peru and Ecuador	25,000
1875	Venezuela and Colombia	16,000
1886	U.S., Charleston, S.C.	60
1896	Japan, Sea Wave, Sanriku Coast	22,000
1897	India, Assam	1,542
1905	India, Kangra	20,000
1906	U.S., San Francisco, Calif.	700
1906	Chile, Valparaiso	1,500
1908	Italy, Messina	75,000
1915	Italy, Avezzano	29,970
1920	China, Kansu	180,000
1923	Japan, Tokyo-Yokohama	143,000
1932	China, Kansu	70,000
1935	Pakistan, Quetta	60,000
1939	Chile, Chillan	30,000
1939	Turkey, Erzincan	23,000
1946	Eastern Turkey	1,300
1946	Japan, Honshu	2,000
1948	Japan, Fukui	5,131
1949	Ecuador, Pelileo	6,000
1950	India, Assam	1,500
1953	Northwestern Turkey	1,200
1954	Algeria, Orleansville	1,657
1956	Northern Afghanistan	2,000
1957	Northern Iran	2,500
1957	Outer Mongolia	1,200
1957	Western Iran	2,000
1960	Morocco, Agadir	12,000
1960	Southern Chile	5,700
1962	Northwestern Iran	10,000
1963	Yugoslavia, Skopje	1,100
1964	Southern Alaska	131
1965	Chile, El Cobre	400
1966	Eastern Turkey	2,529
1967	Venezuela, Caracas	236
1968	Northeastern Iran	11,588
1970	Western Turkey	1,086
1970	Northern Peru	66,794

Lives Lost in Major U.S. Earthquakes–from *Earthquake Investigation in the United States* (Rev. 1969), U.S. Department of Commerce; OEP data used for 1971 earthquake.

Year	Locality	Lives Lost
1811	New Madrid, Mo.	Several
1812	New Madrid, Mo.	Several
1812	San Juan Capistrano, Calif.	40
1868	Hayward, Calif.	30
1872	Owens Valley, Calif.	27
1886	Charleston, S.C.	60
1899	San Jacinto, Calif.	6
1906	San Francisco, Calif.	700
1915	Imperial Valley, Calif.	6
1918	Puerto Rico (tsunami from earthquake in Mona Passage	116
1925	Santa Barbara, Calif.	13
1926	Santa Barbara, Calif.	1
1932	Humboldt County, Calif.	1
1933	Long Beach, Calif.	115
1934	Kosmo, Utah	2
1935	Helena, Mont.	4
1940	Imperial Valley, Calif.	9
1946	Hawaii (tsunami from earthquake in Aleutians)	173
1949	Puget Sound, Wash.	8
1952	Kern County, Calif.	14
1954	Eureka-Arcata, Calif.	1
1955	Oakland, Calif.	1
1958	Khantaak Island and Lituya Bay, Alaska	5
1959	Hebgen Lake, Mont.	28
1960	Hilo, Hawaii (tsunami from earthquake off Chile coast)	61
1964	Prince William Sound, Alaska (tsunami)	131
1965	Puget Sound, Wash.	7
1971	San Fernando, Calif.	65

Visual 31

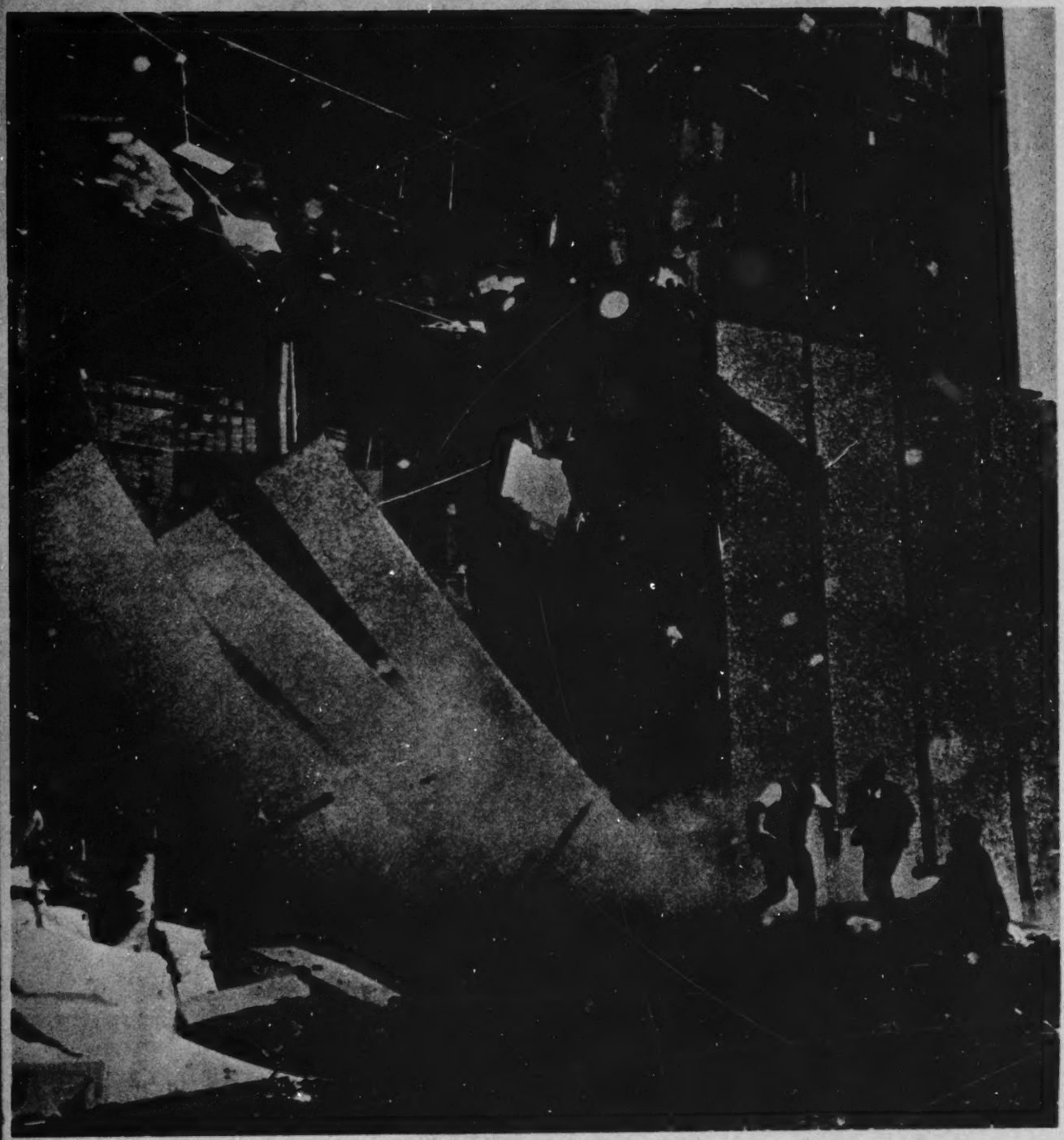
Earthquakes are the most devastating phenomena of nature. Their severity is measured by a number of procedures. The system used by many nations, including the United States, is known as the Richter Scale. This scale measures earthquake forces on a basis of zero to ten. An earthquake that would measure eight and one-half on this scale would be equivalent to the energy released by 12,000 atomic bombs of the size dropped upon Japan during World War II. We can see that earthquakes possess the force to cause considerable destruction. Records have been kept of the loss of life from earthquakes since the year 856 (visual 31). The greatest loss of life occurred in 1556 when 830,000 people were killed in Shensi, China.

What Causes an Earthquake? Although we usually think of the earth as being a solid mass with its many parts (mountains, valleys, plains, oceans) immovable, it is actually in a constant state of motion. Not only is the earth moving around the sun but the forces existing within the Solar System act upon the earth and produce stresses and movements within the earth's surface itself. These stresses and movements produce a great deal of tension and strain along many points in the surface. When this strain becomes too great, the land mass tends to give way (or slip) at certain weak points called "faults." This slippage and the energy released by it produce the violent movement within the earth's crust we call an "earthquake."

What Happens During an Earthquake? The onset of a major earthquake is initially signaled by a deep rumbling or by disturbed air making a rushing sound followed shortly by a series of violent motions in the ground. The surroundings seem to disintegrate. Buildings, bridges, dams, tunnels, or other rigid structures may be sheared in two or collapse when hit by violent motions in the ground (visual 32). Vibrations are sometimes so severe that large trees are snapped or uprooted. Chimneys, high-rise buildings, water tanks, and roads are especially vulnerable to these vibrations. In poorer countries where mud, brick, and adobe are used extensively in construction, collapse is often total even to the point of returning some of the mud bricks to dust (visual 33). With this initial destruction comes the danger from broken water and gas mains, fallen power lines, and fires started by explosions that might take place during the earthquake. Fires are often more destructive than normal because much equipment and water sources used for fighting them have been destroyed or immobilized. The destruction of San Francisco in 1906 was caused by the fires that sprang up following the quake rather than by the earthquake forces themselves. Rescue operations are also hampered because of destruction of roads and vehicles.

Landslides

Landslides are also an especially harmful result of an earthquake (visual 34). Sometimes more lives are lost from this side effect than from any other. The earthquake that occurred in Peru in 1970 killed 70,000. Forty thousand of those killed during that earthquake lost their lives when they were swept away by a landslide.



Visual 32

52

53

Visual 33

Visual 34

Visual 35

Visual 36

Visual 37

Tsunamis

Tsunamis are deadly offspring of earthquakes. Sometimes the greatest danger posed by earthquakes comes not from the trembling and heaving of the earth's surface but from large waves of water that are generated out in the ocean by the forces of the earthquake. Even though these waves can travel at speeds approaching 600 miles an hour while they are over deep water, as they near the shoreline, their speeds diminish rapidly, striking with an average speed of 40 miles an hour. The damage from a tsunami does not come so much from its speed as from the height of the water. Tsunami waves can reach a height of 100 feet or more when they strike the coastal waters engulfing everything in their path (visuals 35, 36, and 37). For those people living within a few miles of the coast the tsunami is a tremendous threat.

The forces involved in a tsunami cannot be controlled. Once a tsunami has been set in motion and is approaching the land, the main chance for survival lies with proper warning and proper action to reduce the hazard prior to its striking the coast. If adequate warning is received (2 - 5 hours), then action can be taken: people can be evacuated, the coastline can be cleared of ships, buildings can be shuttered, and sandbags can be placed where they will be effective.

Providing warning is the purpose of the Pacific Tsunami Warning System headquartered in Honolulu, Hawaii. They monitor disturbances throughout the world that result in tsunamis. Once a disturbance has taken place and a tsunami has formed, the Tsunami Warning System will issue "tsunami warnings" to the coastline areas that are threatened.

Even though we are able to predict the tsunami and possibly give adequate warning, it is not yet possible to forecast with a useful degree of precision the time or place the earthquake will occur that produces the tsunami. Seismologists (scientists who deal with the earth's surface and the stresses and pressures affecting it) are aware of areas where earthquakes are most likely to strike, but are generally unable to predict the exact time or place. It should then be assumed that earthquakes will strike without warning. Therefore each person's own knowledge and preparation for an earthquake are vital in order to insure that person's survival during the immediate crisis of the disaster.

There are safety rules that are unique to the earthquake. If you follow these rules, your chance of surviving is much greater.

Earthquake Safety Rules

<u>During the Shaking:</u>

1. Do not panic. The motion is frightening but, unless it shakes something down on top of you, it is harmless. Contrary to what is shown in movies, the earth does not yawn open, gulp down

a neighborhood, and slam shut. Keep calm and ride it out.

2. If it catches you indoors, stay indoors. Take cover under a desk, table, bench, or in doorways, halls, and against inside walls. Stay away from glass.

3. Do not use candles, matches, or other open flames, either during or after the tremor. Douse all fires.

4. If the earthquake catches you outside, move away from buildings and utility wires. Once in the open, stay there until the shaking stops.

5. Do not run through or near buildings. The greatest danger from falling debris is just outside doorways and close to outer walls.

6. If you are in a moving car, stop as quickly as safety permits, but stay in the vehicle. A car is an excellent seismometer, and will jiggle fearsomely on its springs during the earthquake; but it is a good place to stay until the shaking stops.

After the Shaking:

1. Check your utilities, but do not turn them on. Earth movement may have cracked water, gas, and electrical conduits.

2. If you smell gas, open windows and shut off the main valve. Then leave the building and report gas leakage to authorities. Do not reenter the house until a utility official says it is safe.

3. If water pipes are damaged, shut off the supply at the main valve.

4. If electrical wiring is shorting out, shut off current at the main meter box.

5. Turn on your radio or television (if conditions permit) to get the latest emergency bulletins.

6. Stay off the telephone except to report an emergency.

7. Do not go sight-seeing.

8. Stay out of severely damaged buildings; aftershocks can shake them down.

Volcanoes

Volcanoes in Our History. Even though for the United States volcanoes pose no immediate threat to life and property, on a world-wide scale, they have been very destructive. Practically every student has heard of the destruction of Pompeii by the eruption of Mt. Vesuvius in 79 A.D. That volcano buried the entire city (rediscovered in 1595) and its 16,000 inhabitants under a thick blanket of volcanic ash and dust. Most of those killed died from suffocation and the layer of ash formed a mold around their bodies as they fell. The fear, anguish, and pain felt by the people as they died can be seen in the impression left on the hardened ash mold by their facial expressions. In the twentieth century even greater volcanic disasters have occurred. The city of St. Pierre, Martinique, was completely destroyed by the 1902 eruption of Mt. Pelee. Only two of that city's 30,000 inhabitants survived the eruption. In 1963, 1,500 lost their lives to the eruption of Mt. Agung, Bali, Indonesia. Some other losses were:

1. Skaptar Jokull, Iceland, 1783, which killed 10,000 people, most of the island's livestock, and even crops in Scotland 1,000 kilometers away;

2. Tamboro, Indonesia, 1815, by which 12,000 perished directly and up to 70,000 because of famine following destruction of the crops;

3. Mt. Pelee, Martinique, 1902, whose pyroclastic flows completely destroyed the city of St. Pierre in a matter of minutes, killing all but two of its 30,000 inhabitants;

4. La Soufriere, St. Vincent, also 1902, which took 2,000 lives and caused the extinction of the Carib Indians;

5. Kelut, Indonesia, 1909, killing 5,500 people;

6. Mt. Lamington, Papua, 1951, with 6,000 fatalities;

7. Mt. Agung, Bali, Indonesia, 1963, killing 1,500;

8. Villarica, Chile, 1963-64, which forced 30,000 to evacuate their homes; and

9. Taal, the Phillippines, 1965, claiming 500 lives.

Why Do Volcanoes Occur? Volcanoes like earthquakes are the result of stresses within the earth's crust and the pressures that build up because of these stresses. As the crust of the earth shifts and moves, rocks and other material are forced to great depths within the surface. As a result of this the pressure exerted upon this material increases and tremendously high temperatures are generated. The combination of this pressure and temperature causes the rocks to melt into molten masses which in turn exert pressure upon the surrounding earth. Imagine a pan of water heating on a stove. Put a lid on that pan and watch what happens.

As the pressure inside that pan builds up, the lid is lifted around the edges to let the steam and boiling water escape. That same principle is involved with volcanoes. As this pressure builds up, the molten rock (lava) is pushed up to the surface to be forced out of its weak points (sometimes with explosive force) to form a mountain ulcer or eruption called a volcano (visual 38).

Dangers from Volcanoes. The chief dangers of volcanic eruption are airborne clouds of volcanic debris and ash, and the flow of lava and solid particles. Lava flows are the most widely known characteristic of volcanoes (visual 39). The molten rock as it is forced to the surface spills over the cone (mountainous projection of the volcano formed by initial lava flow) and flows over the land in wide rivers of destruction.

Ash and cinders are formed in the air at the initial eruption of a volcano. Continued eruption adds to the cinder clouds. These materials are blown into the air where they hang suspended to fall back to earth sometimes quickly, sometimes hours later. It was the choking, flying debris that wiped out Pompeii in 79 A.D. Much of central Oregon was covered with a six-inch deep layer of ash 6,600 years ago by the eruption at Crater Lake. The extent to which devastation occurs in a particular area is determined chiefly by the size of the particular volcanic eruption. A volcano may be so small as to pose no threat to life or property, or it can be large enough to destroy not only the surrounding countryside, but produce effects (clouds of debris) that will damage an area hundreds to even thousands of miles away.

What Is Being Done To Save Lives? Because of the nature of the forces involved, volcanic eruptions cannot be avoided. Thus, the prime objective in defending against their destructiveness is twofold: prediction of where and when a volcano will probably occur and the reduction of the damage that will take place during a volcanic eruption.

A considerable amount of effort has gone into the predicting and detecting of volcanic activity in the United States and around the world. The use of instruments similar to those used to measure earthquakes enables experts to determine whether conditions are developing that could lead to a volcanic eruption. Aerial photography using infrared devices is used to measure temperature activity in a volcanic area. From these measurements it is often possible to predict an approaching eruption.

A program of hazard reduction is tied into two procedures: "risk mapping" of areas likely to be affected by lava and debris flows in a volcanic area; and the control over the uses of those high-risk areas. Through these procedures it is possible to save lives and property. This can only be done if each person makes it his responsibility to know what must be done and helps to carry it out.

Visual 38

Visual 39

Droughts

The growing of food is an essential activity of man. He must have land capable of supporting the growing of food. A shortage of water in some areas of the world produces a shortage of food. The United States is fortunate in having sufficient land that is geographically situated to grow enough food for the people of this country and export food to other countries. A modern transportation system permits the distribution of food to meet the needs of the people.

The United States has never had a nationwide drought. Nevertheless, drought could be a serious problem, particularly in the West and Midwest (visual 40). The term "drought," as used here, refers to a meteorological phenomenon describing a condition in which precipitation is significantly less than the long-term average for that area and when this deficiency is great enough and long enough to affect mankind (visuals 41 and 42).

A drought may be described as mild, moderate, or severe. (visual 43). If the drought involves enough people, then we may have a disaster or emergency, but not of the violent destructive type. Severe drought can produce shortages of food and water, thus creating a threat to survival. Certain areas in Africa have recently experienced severe drought resulting in starvation for many.

Water conservation measures such as restricting the use of water to drinking and food preparation may be necessary in severe drought areas. Installation of pipe lines, and the hauling and storage of water have been necessary in some areas.

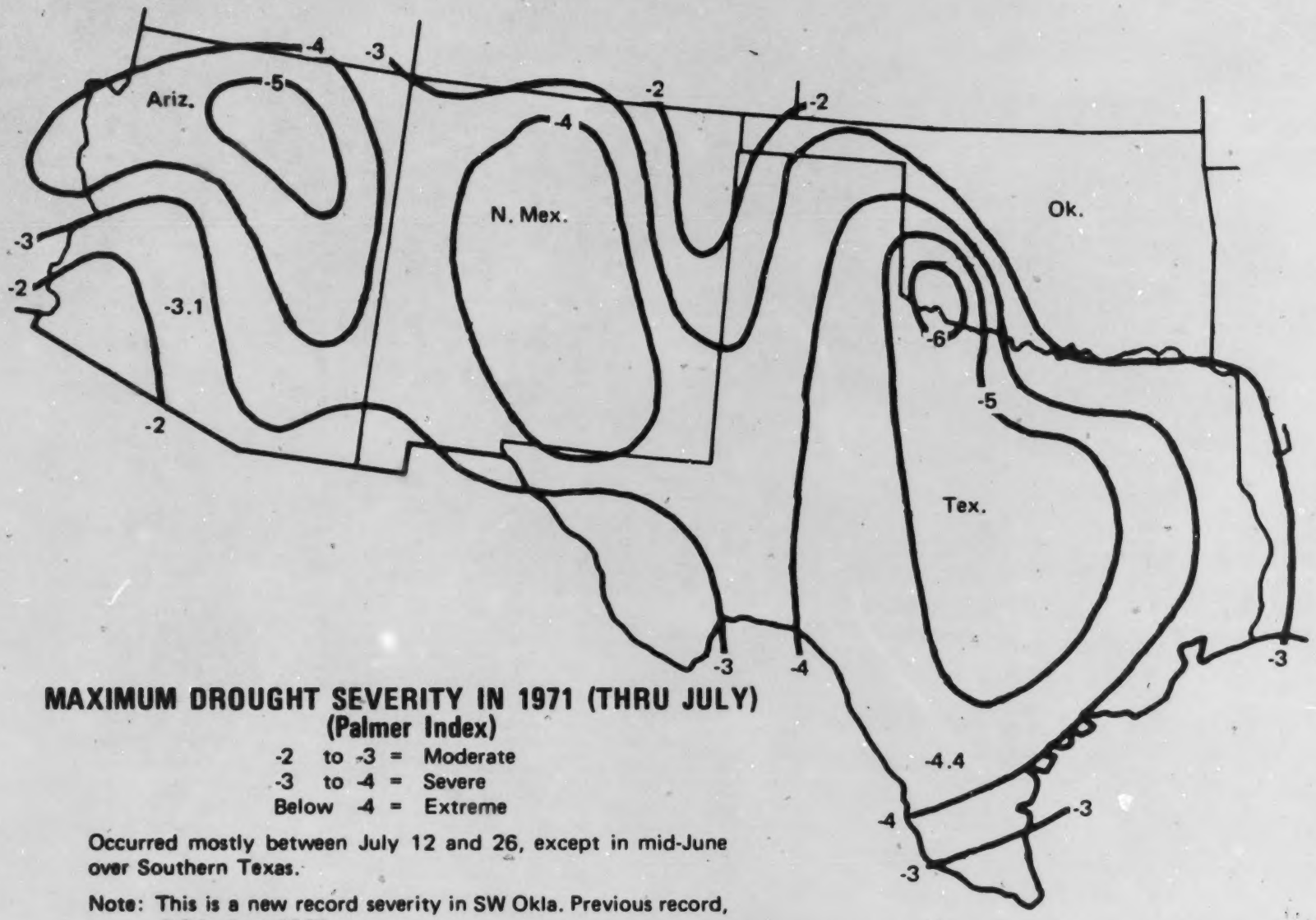
A temporary loss of water for reasons other than drought has occurred many times in the United States. Any city that does not have a reserve supply of water could face this emergency.

Other Disasters/Emergencies

The list of disasters or emergencies confronting individuals and their governments is long. The nature and effects of natural disasters have been discussed in previous sections.

There are other emergencies that can develop into a disaster if the proper actions are not taken.

Forest and grass fires do not fit into either man-made or natural disaster categories completely. The origin of the fire may be man-caused or started by natural forces. The destruction of property and loss of life due to forest or grass fires is a type of emergency needing attention by individuals and government.



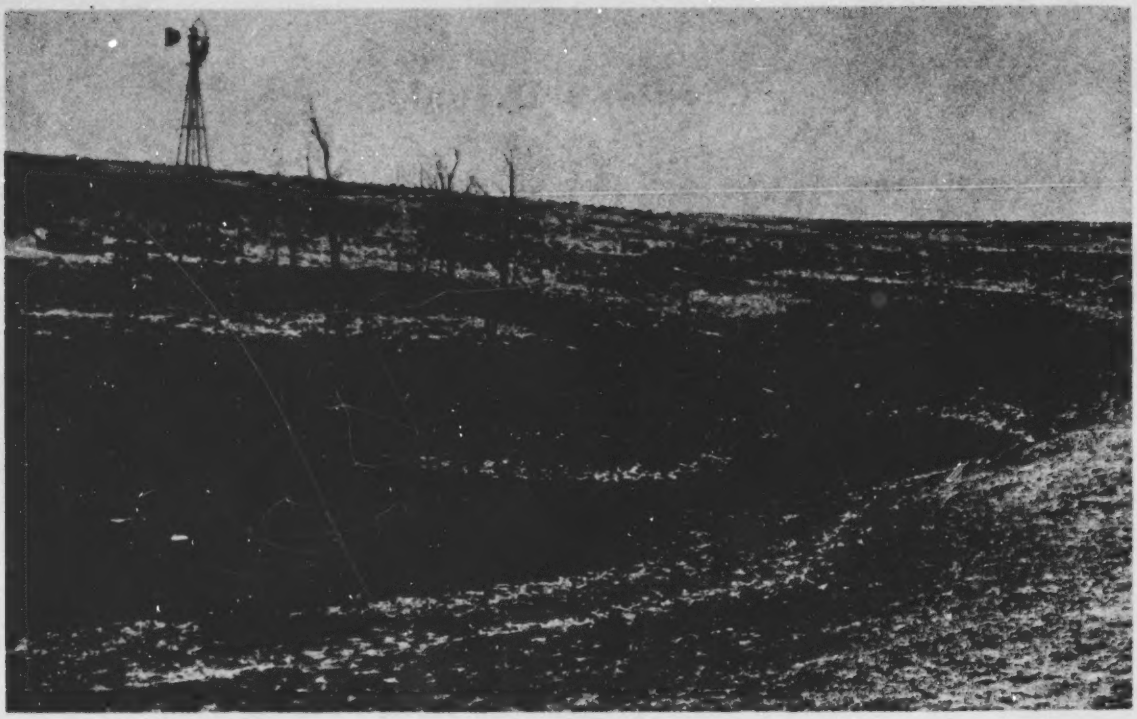
MAXIMUM DROUGHT SEVERITY IN 1971 (THRU JULY)
(Palmer Index)

-2 to -3 = Moderate
-3 to -4 = Severe
Below -4 = Extreme

Occurred mostly between July 12 and 26, except in mid-June over Southern Texas.

Note: This is a new record severity in SW Okla. Previous record, -5.0 in Aug. 1967.

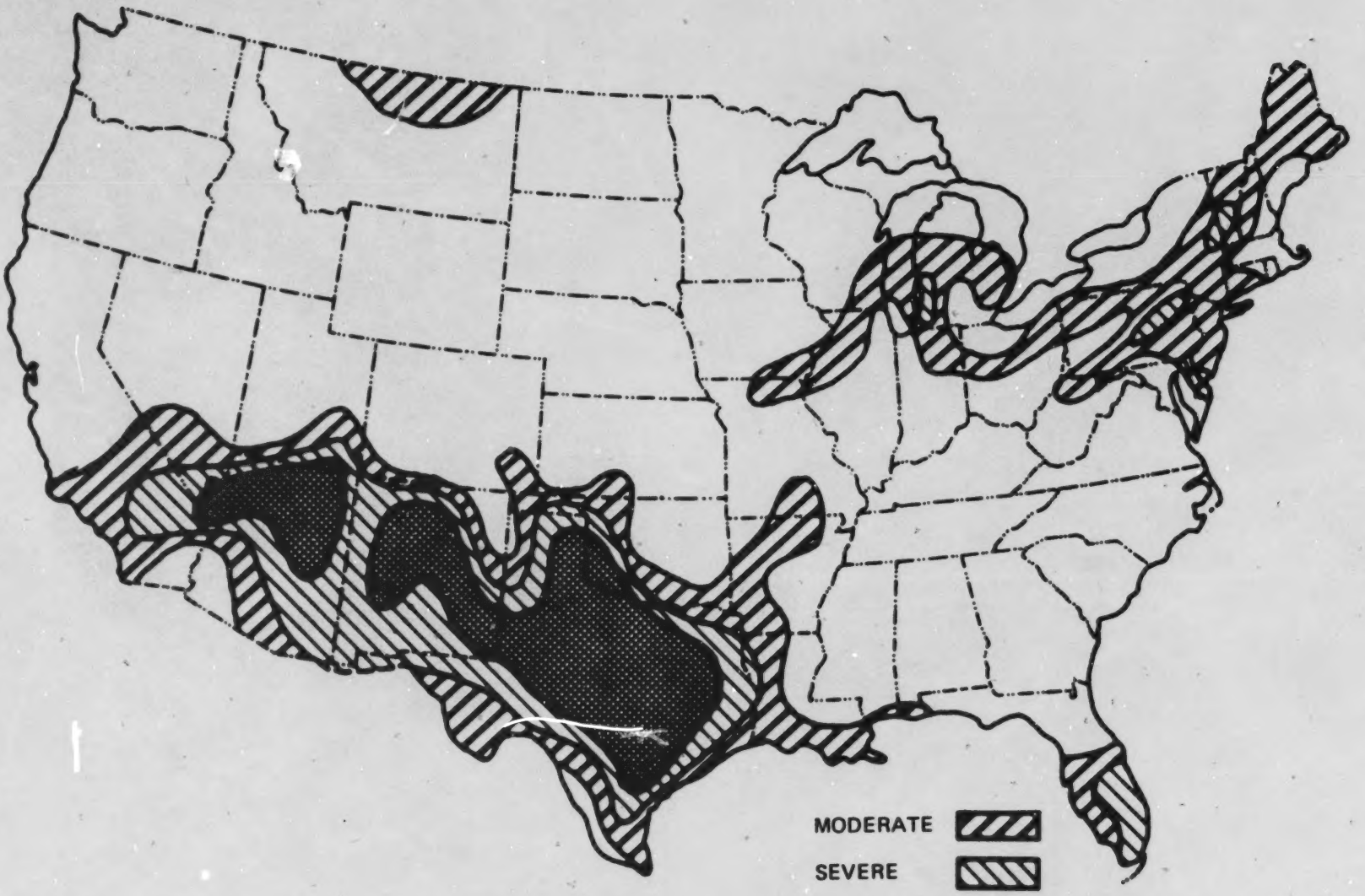
Palmer Drought Index, for the 1971 drought in the Southwestern United States—U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service.



Visual 41

–Drought-Stricken Farmland: a dry waterhole on an Oklahoma farm (above); in Texas, soil deposited from a nearby wheatfield upon sorghum stubble left to control blowing (below)–U.S. Department of Agriculture photos.

Visual 42



Drought Severity Chart: July 17, 1971—NOAA.

Visual 43

Chemical accidents may occur requiring the evacuation of people from their homes and posing a serious hazard to man and beast. These accidents are generally referred to as man-made disasters or emergencies whether it be a train or truck wreck, as the hazard is generally due to the acts of man.

The transportation and use of radioactive substances increase every year. Although the possibility of the release of radioactive substances thereby creating a hazard to man is remote, accidents do happen involving radioactive substances. In most instances, the hazard is minor in nature and does not produce a significant hazard to man.

All of these types of emergencies will be discussed in the following pages.

Forest and Grass Fires

What Are the Causes of Forest Fires?

Only about ten percent of the forest fires that have taken place in the United States have been the work of "Mother Nature" in the form of lightning. The remaining 90 percent have been started by man. The relationship of man to the causes of forest fires is even clearer when we realize that the cause listed as incendiary actually means fires started intentionally by arsonists (people who maliciously start fires in order to cause destruction). Either by intention, accident, or carelessness people are responsible for the destruction of one of this nation's most valuable resources (visual 44).

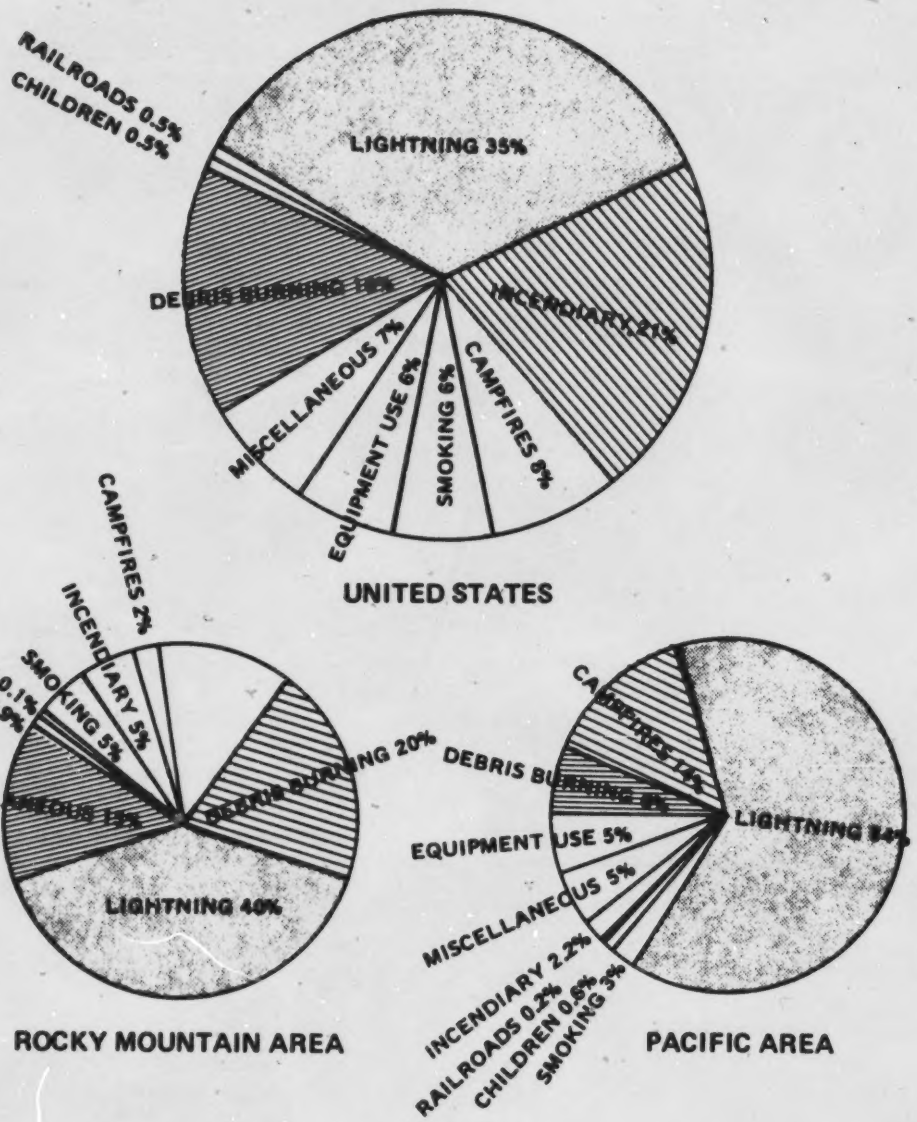
How many times have people flipped a cigarette out of their car window while driving through heavily forested areas? How many people toss cigarettes and matches on the ground without regard as to where they land or whether they are still burning? (visual 45). How many people leave their campsite after a weekend, with the campfire still smoldering? Do most people take the time to insure that the fires are extinguished? These may seem like ridiculous questions. The questions would seem so only to those who have not seen the destruction of a forest or grassland by fire. These fires destroy trees, animals, houses, and, too often, people.

In the last five years there have been 600,000 forest wildfires identified in the United States. Three hundred and sixty thousand of these have occurred in the Southeastern part of the country (visual 46).

Forest Fires in Our History. There have been several large fires recorded in the history of the United States. The worst fire, with regard to the amount of forest acreage destroyed, took place in 1825 in Maine and New Brunswick. Three million acres of land were destroyed by that fire and 160 persons were killed. Probably the worst fire in the history of this or any

ACRES BURNED—BY FIRE CAUSES

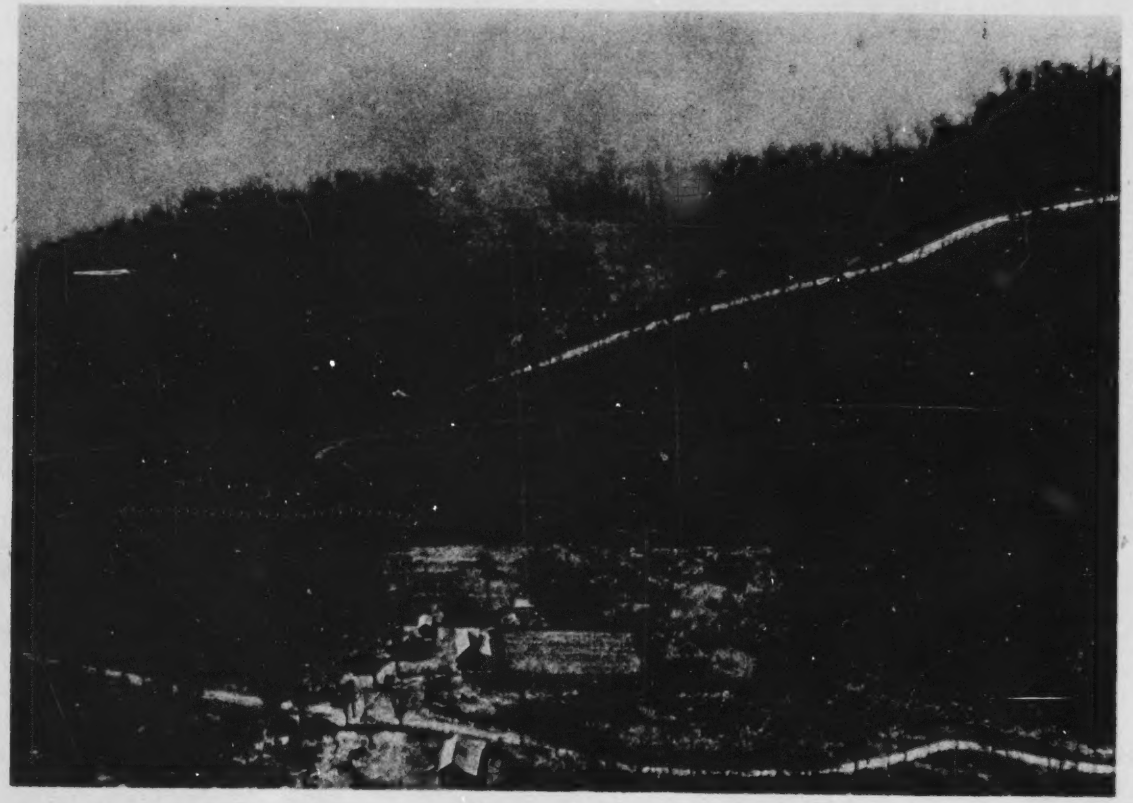
BY PERCENT OF FIVE YEAR TOTAL 1966—1970



Acres Burned, by Fire Causes, 1966-1970 (by percent of 5-year total)—U.S. Department of Agriculture, Forest Service.

Visual 44

Visual 45



Visual 46

other modern nation was the disastrous Peshtigo fire in October, 1871, in Wisconsin. That fire killed over 1,500 people as it burned down 1,280,000 acres of forest land. During that same month 750 lives were lost in the Humboldt fire, also in Wisconsin. In 1933 a fire in the State of Oregon destroyed as much timber as had been cut in the United States the entire previous year. More recently, southern California during a one-month period of 1970 experienced some 1,260 fires which burned 600,000 acres, killed 14 people, and destroyed some 900 homes. By number alone the Southeastern part of the United States experiences the greatest threat from forest fires. If we base the greatest threat upon the idea of size of forest acreage destroyed, the Western States suffer the most from forest fires each year.

Today's largest forest fires take place in the vast interior regions of Alaska. Caused by lightning and campfires, fires in these isolated areas burn for days, even weeks, before they are spotted and action can be initiated, if possible, against them. In 1969 four million acres of trees were destroyed by these fires. Before federal fire control programs began in 1939, the average annual toll was between five to eight million acres.

The number of forest fires that will occur each year depends upon a number of factors: fuel, weather, geographic region, and others. If the weather is dry and hot and a heat source is available from lightning, campfires, smokers, machinery, and equipment use; if the fuel is loose enough for oxygen to mix with leaves, splinters, needles, or twigs; and if there is even a slight breeze blowing to provide a constant supply of oxygen, then a forest wildfire is very likely to occur.

When these conditions are in the proper combination (for example: a forest that is dry and has experienced very hot temperatures for a number of days in succession), wildfires will occur at an almost predictable rate. This rate, however, can be drastically altered upward if outside influence exists such as human carelessness and maliciousness. For different areas of the country the time for that right combination of factors will vary. March is usually the month of highest wildfire occurrence in the Southeast.

A major fire destroys all living and nearly all organic matter on the land. Aside from the loss of lives and property, there is the larger loss of all the benefits provided to the environment and man by the forest. Even though there is the destruction of living creatures, the greatest effect of a forest fire is perhaps that upon which no value can be placed -- the loss of the benefits of a green, growing forest environment on our atmosphere, soil, and water. A forest fire both pollutes the air with the smoke it produces and, more importantly, it destroys the forest's ability to purify our air. Forest fires also destroy the soil covering that protects the soil from erosion.

Fire Prevention. The struggle against the destructiveness of forest fires and their causes (mainly man) has taken a three-pronged

attack. The level most familiar to people is that of educating them to the dangers of forest fires and the ways they as individuals can contribute to the fight. Good old Smokey the Bear is the chief symbol of this effort. In fact, some surveys have shown that "Smokey" is the best known symbol in America. The bear has become so popular that Mexico uses the "Bear" symbol but calls him "Simon El Oso" (Simon the Bear).

The United States Forest Service maintains a nationwide fire detection and protection system with individual units of men and machines assigned to specific national forests. Comparable state organizations also exist. United States Forest Service and State Forestry Commissions cooperate continually to prevent, detect, and combat forest fires.

Forest wildfire fighting is an exacting skill which one can never truly master. Since fires are different, proficiency is gained only through experience. There are, however, certain steps that fire fighters take when confronting each wildfire.

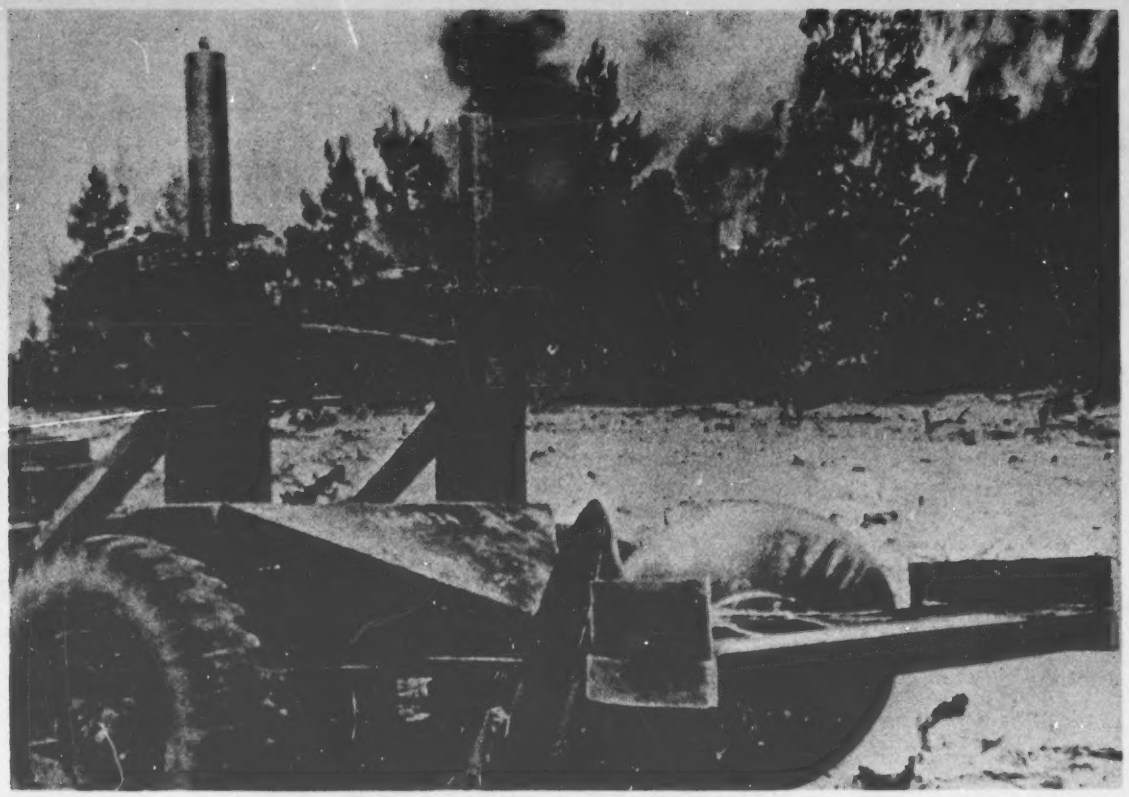
They size up the fire. A determination is made as to which direction it is going and what is in its path. They consider the rate the fire is burning, the time of day, weather conditions, fuel types, and the size or length of fire to be controlled. A survey is made to determine hazards, natural barriers, access roads, water sources, manpower, and escape routes. A determination is made for each fire as to the best method of attack and the best way to attack to sustain the smallest loss. There may be tractors and fire plows available (visual 47) or there may be only men with fire rakes, flaps, and shovels. Often the equipment and manpower available will determine the method of attack. There are two methods: the direct method and the indirect method.

Putting water or sand right onto the edge of the burning fire itself, smothering the fire with fire flaps, and removing all combustible materials back into the burned area are all ways of attacking a fire directly. These may be done safely only on smaller "cool" fires.

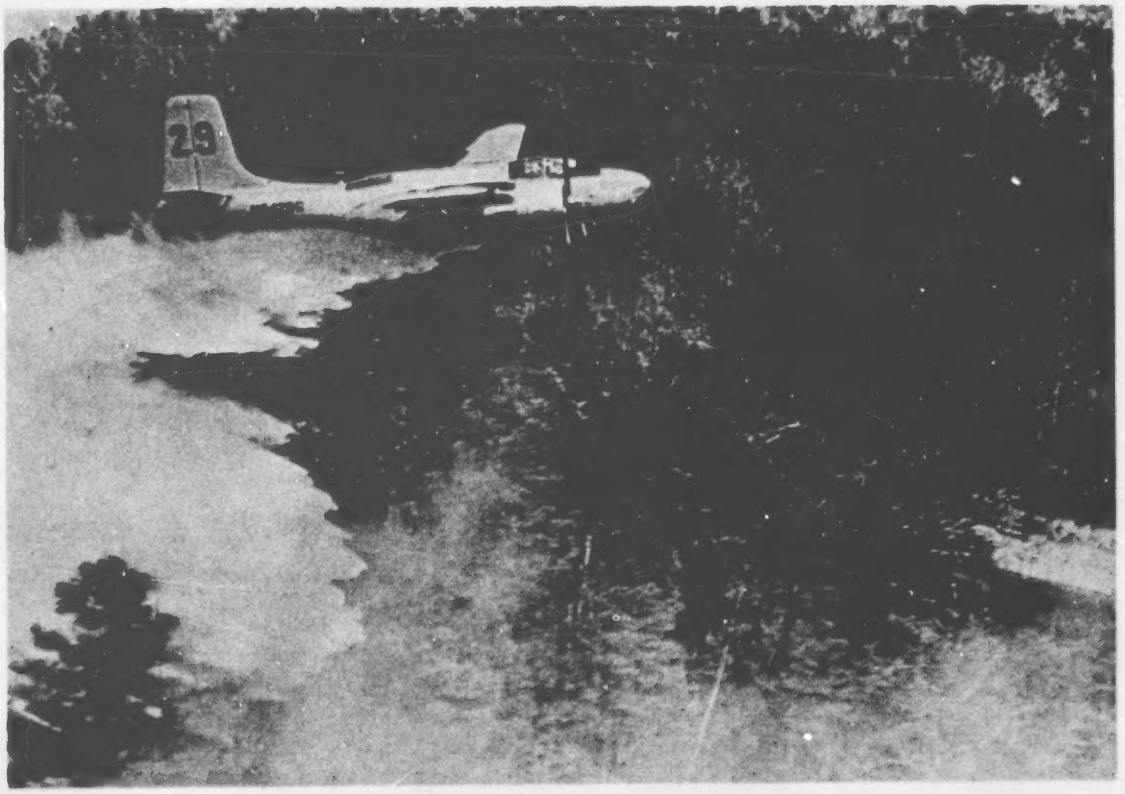
Going ahead of the fire and removing all fuel from a strip parallel with it so that the fire will burn up to the strip and stop is an example of the indirect method of attack. Backfiring in front of an oncoming fire is another indirect method. These are safest with large fires.

The final stage in fighting a forest fire is to mop up. This is the process of making a fire safe once it is under control by extinguishing or removing all burning material that is anywhere near the edge of the burned area.

New methods are also being developed to combat forest fires. Aerial suppression methods are being used more and more in modern forest wildfire fighting programs (visual 48). Light aircraft are useful in giving the fire suppression boss a bird's-eye-view



Visual 47



Visual 48

of the fire lines and allowing him more effective control of his men and equipment. Water bombers can move tons of water or chemicals directly onto the fire. Both methods have been used successfully for several years.

Aerial wildfire detection is a technique that is very effective. One advantage of aerial detection is that exact fire location can be given much more quickly than by other detection methods. Highly mobile suppression ground crews can get to fires while they are still small and easily suppress them. Infrared camera and scanners are also being used aboard planes for fire detection at night. They can make a distinction between a small camp stove and an infant wildfire from thousands of feet of altitude.

The most effective firefighting, however, is done before the fire ignites. Therefore, much new work and research are being done in forest wildfire prevention. State Forestry Commissions employ experts in fire prevention who develop programs that will significantly reduce the number of careless and woods arson fires. These types are the most numerous.

Forest firefighting is a very dangerous job. Many firefighters have been killed. In the Great Idaho Fire of 1910, 85 persons lost their lives. Seventy-four of these were firefighters.

We need to develop an understanding of the problem of forest fires and develop an attitude of concern toward its solution. For only with a determined effort on the part of each one of us can we, the major cause of the problem, meet the challenge and solve it. As Smokey the Bear says, "Only you can prevent forest fires."

Chemical Incidents/Accidents

Chemicals in daily use by the American people number in the thousands. Many of these chemicals are hazardous if not properly used and controlled. Some of them could and do cause emergencies affecting a substantial number of people. The transportation of chemicals is increasing as the demand for newer substances by industry increases. Rail, water, and highway transportation are all involved in the movement of hazardous substances. Accidents involving chemical substances occur daily somewhere in the nation.

Chemical threats to people are generally of four types: (1) inhalation, (2) skin exposure, (3) swallowing, and (4) eye exposure. Current first aid practices should be used in treating victims. Chemical accidents usually occur in such a manner that warning time is very short. The cooperation of the individual citizen is necessary for prompt reporting of accidents. Should evacuation be necessary, careful attention to instructions is every citizen's responsibility. Persons not affected by the hazardous chemical should not attempt to enter the danger area. Innocent bystanders in some cases become victims. If you can be of assistance to an official at the scene, you should help.

Radiological Incidents/Accidents

The widespread use of radioactive materials in industry, hospitals, and power generating facilities has increased the possibility of an accident. An accident could occur in the facility where the material is being used or in the transport of radioactive material. The hazard to life from these incidents/accidents is minimal but the protection of the public from unauthorized exposure is of prime consideration. There are plans to deal with these emergencies whether a nuclear generating facility or a transportation accident. All of these plans require a certain amount of cooperation from individuals that might be involved. Knowledge of what to do in the event you become involved is important.

If you should witness an accident that might involve radioactive materials, notify the police immediately. (Labels may be posted on the truck or train and on the packages they are carrying.) Then, do only those things that are necessary to rescue trapped individuals and to administer lifesaving first aid.

Keep people back until police arrive and then report to them your every action. Do not leave the scene until you have been checked for radioactive contamination. If you should see any of the labels shown in visual 49, radioactive materials are involved. Do not attempt to make an evaluation of the hazard. Personnel from the Nuclear Regulatory Commission or State Health Agency will be contacted for technical assistance by the police.

Radiological Safety Procedures

The following safety rules should be observed at the scene of an accident or incident involving radioactive substances.

1. Rescue injured or trapped people and remove them from immediate danger.

2. Administer lifesaving first aid only. (stop bleeding, artificial respiration, etc.)

3. Stay out of smoke if there is a fire.

4. Fight fire if necessary to save lives.

5. Do not eat or drink while in the area and until you have been checked for radioactive contamination. If you should become contaminated, the Nuclear Regulatory Commission or Public Health Representatives will advise you of the necessary actions to take.

6. Do not remove, handle, or use any materials at the scene and advise others to do likewise.

7. Inform emergency services personnel of your actions prior to their arrival.

HANDLE CAREFULLY
RADIOACTIVE
CONTENTS
I

RADIOACTIVE
HANDLE CAREFULLY
CONTENTS
NO. OF CURIES
II

RADIOACTIVE
HANDLE CAREFULLY
III

Visual 49

A personal decision has to be made at the scene of an accident as to whether you want to get involved.

Conclusion

Disasters and emergencies take many forms. A simple incident may grow into a major emergency if it is not properly handled. A certain amount of knowledge of what to do and safety precautions to observe could save lives and minimize the emergency condition. If you will remember the safety rules and observe them prior to and during a disaster or emergency, then you will have helped officials to solve the problem. This will enable officials to use their time and resources to the best advantage.

CHAPTER TWO

SURVIVAL IN OUR NUCLEAR AGE

Introduction

Throughout history man has suffered from the destruction caused by natural and man-made disasters. He has seen countless lives lost and immeasurable suffering from floods, hurricanes, earthquakes, and other natural disasters. He has also experienced the worst of all man-made disasters -- war. Today man is still facing these disasters, still struggling to survive, both as an individual and as a species. Of all the formidable challenges none possesses greater dangers than modern nuclear warfare.

The development of nuclear energy has created a new and uncertain element in man's world. Nuclear energy has served a variety of peacetime uses. However, the possibility of destruction through the use of nuclear weapons does exist and is a never-ending threat to man's struggle for a peaceful existence.

Since it was first used, the atomic bomb has "mushroomed" into a cloud that threatens all mankind (visual 50).

The two bombs dropped upon Japan in August, 1945, were very small compared to the destructiveness of modern thermonuclear weapons. This fact is made even more startling when we realize that one of those bombs, the one dropped on Hiroshima, killed 68,000 people, injured another 76,000, and destroyed more than 62,000 buildings.

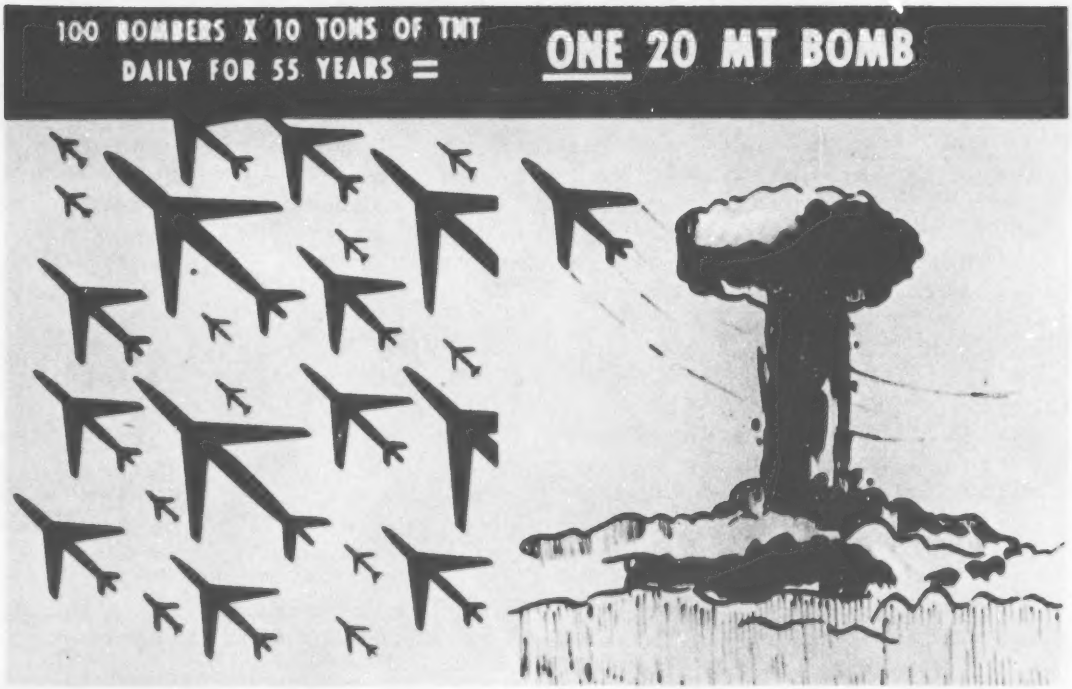
The illustration (visual 51) shows the destructive force of one twenty megaton nuclear weapon as compared to the conventional explosive TNT.

The Problem. It is estimated that the two major nuclear powers -- the U. S. and the Soviet Union -- each possesses over 5,000 of these nuclear weapons. The problem for the world is even more evident when we realize that as of 1975 many other nations have developed or are developing these powerful weapons of destruction.

With the beginning of the "Cold War" between the U. S. and the Soviet Union following World War II, the friction between the two powers has often brought the world to the brink of nuclear disaster. With the development of missiles capable of striking countries thousands of miles away in just a few minutes, the reality of what could happen has heightened world tension and fear (visuals 52 and 53). The Cuban missile crisis (1962) showed the people the dangers inherent in the cold war.

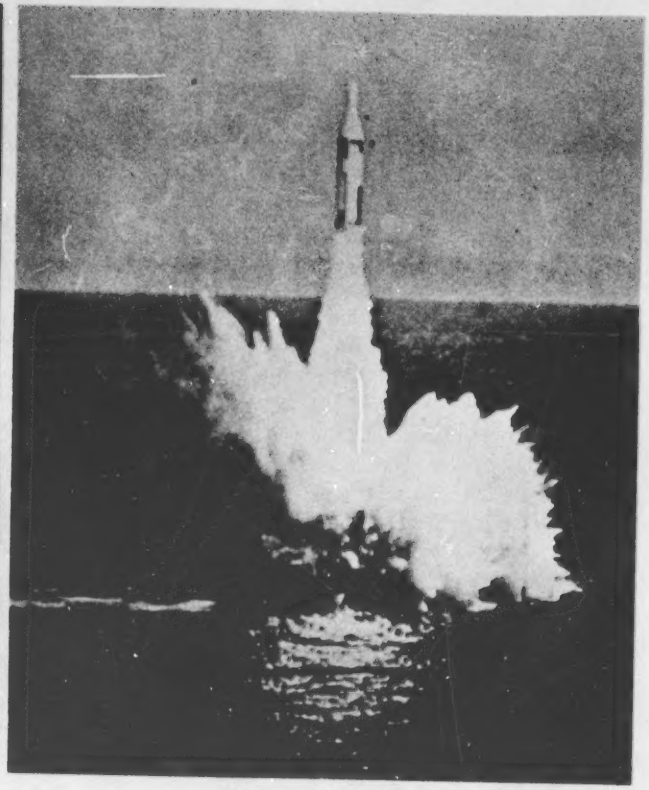
World crises and conflicts have also increased the chances for nuclear war. The Korean War in the 1950's raised this vital

Visual 50



Visual 51

Visual 52



Visual 53

Visual 54

'78

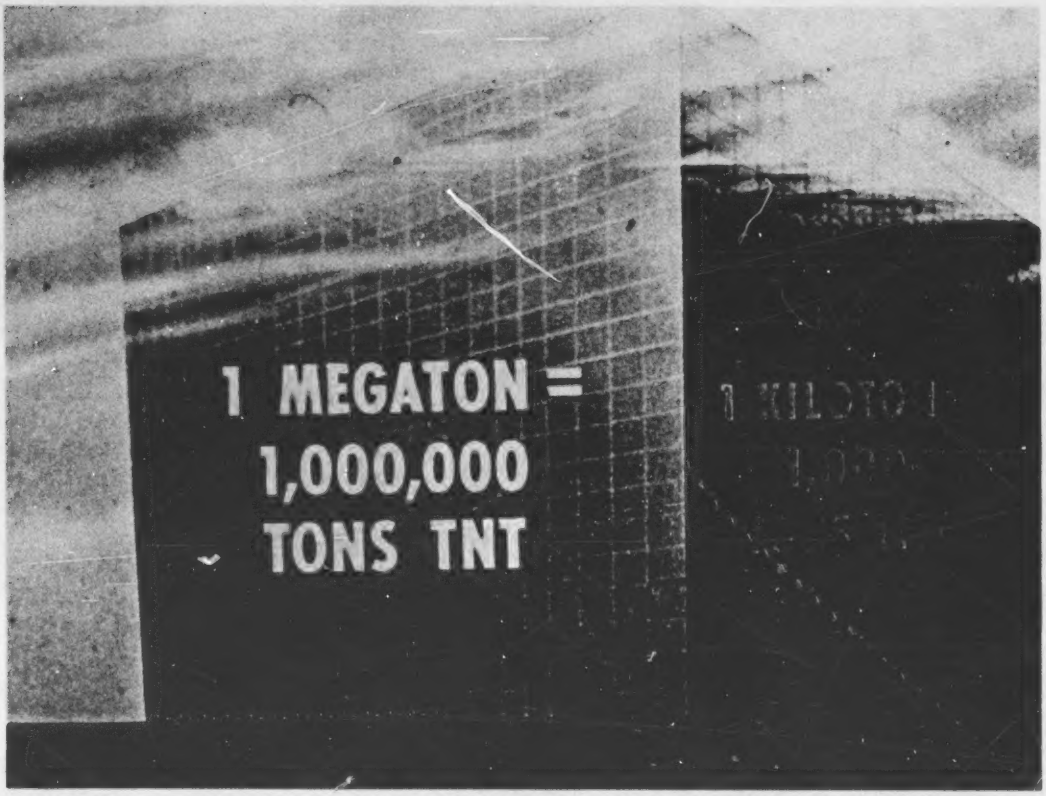
issue. More recently the conflicts in Southeast Asia and the continuing crisis in the Middle East have added to the fear that a nuclear war might result from such conflicts.

This danger of nuclear disaster has increased because of the number of nations currently possessing nuclear weapons. As of 1975 there are at least six countries who possess such weapons. This number will increase as more nations develop the technology and the desire to build them. As this happens and as conflicts between nations continue to occur, the chances for a nuclear war will increase.

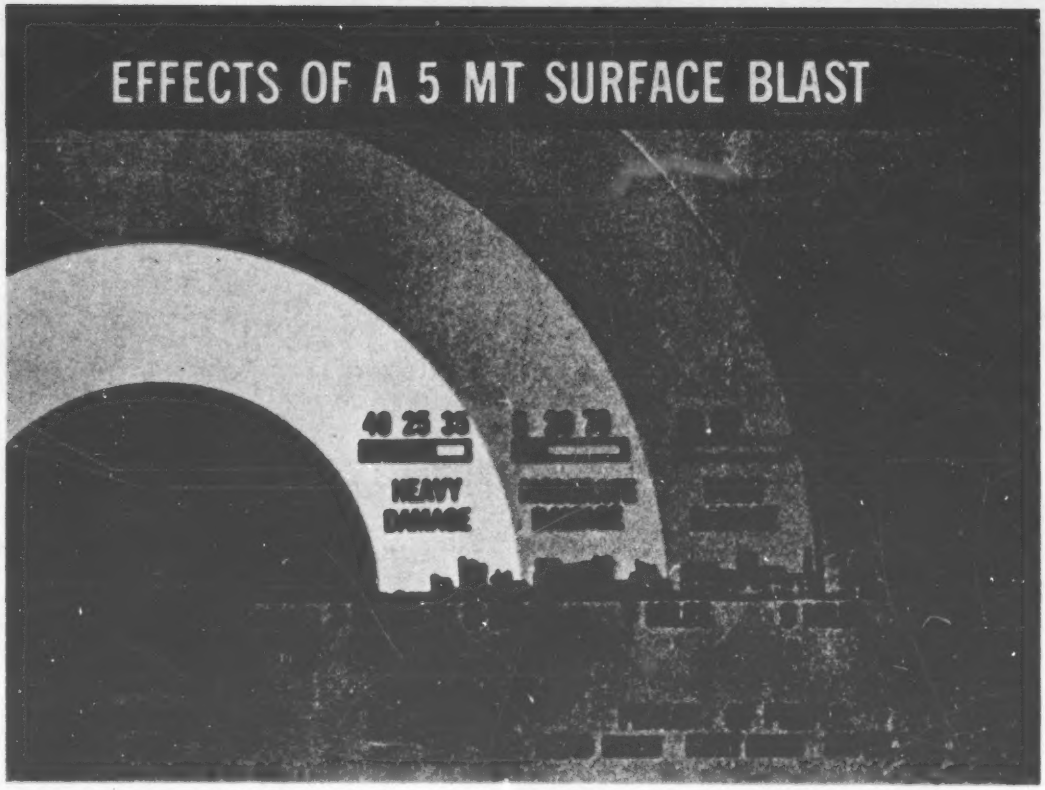
Nuclear disaster then must be seen as a real threat. The nature of the situations and events existing in the world today make it so. It is this fact that has led to a concentrated effort by government and by some individual citizens to establish means of survival. *We can survive a nuclear war* (visual 54), but only if we take the necessary action to protect ourselves from the dangers involved. For if it should ever happen, there will be no second chance to prepare. *Survival depends on planning and preparing now.*

We are all aware of the destructiveness possessed by today's conventional (non-nuclear) bombs. We saw this daily on our television sets as we watched the news reports on the conflict in Southeast Asia. We have seen vast areas of land seemingly demolished by numerous explosions of bombs dropped by Phantom jets and B-52's. Yet even with the apparent destructiveness of these weapons we were constantly reminded that the Viet Cong and North Vietnamese were able to survive such violence by seeking protection from these bombs in deep underground bunkers and reinforced shelters.

Unlike conventional bombs there is no adequate shelter from the explosive power of modern nuclear weapons. The picture of the destruction that took place at Hiroshima testifies to the immense destructive capability of nuclear explosions. You need also to remember that the Hiroshima A-bomb was very small when compared to what used to be called the modern "H-bomb." The explosive power of the two bombs dropped over Hiroshima and Nagasaki was measured in terms of thousands of tons (kilotons) of TNT (visual 55A). Today's modern nuclear weapons are measured in terms of millions of tons (megatons) of TNT. Visual 55B shows the extent of destruction caused by today's modern megaton nuclear weapons. As you can see, there would probably be total destruction within a six-mile circle of the point of explosion. How does that compare with just a few feet for the conventional bombs used during World War II and the Vietnam conflict? For a better understanding of what is involved, find on a map the center of your town. Using the scale on the map draw a circle with a radius of three miles from that center. Do you live in or near that circle? What would happen to the homes, buildings, and people within that circle should a modern thermonuclear weapon explode in the center of your city? This is not to say that your city would be a target for an enemy missile. It probably



Visual 55A



Visual 55B

would not. Quite obviously we do not know where the bombs would drop. But it is also obvious that we need some plan that can be utilized by every state, local community, and even the individual to increase the chance of survival should it ever happen.

Original Survival Plan. The original plan developed in the U. S. for survival in our nuclear age was based upon the concepts of evacuation and dispersal. It was planned that should such a crisis ever occur, our response to it would be very similar to our response to natural disasters. During a natural disaster, such as a hurricane or flood, people are evacuated to safer areas. During a nuclear disaster we originally conceived the idea of moving people out of the population centers into the countryside and even to towns in the outlying areas. These people would be sheltered very much like natural disaster victims are sheltered -- in armories, school gymnasiums, and other large buildings. Once the initial attack was over, the people would then leave these "reception centers" and move back into the area to clean up and rebuild. You can still see signs in some cities designating evacuation routes to be taken should a nuclear attack occur.

Time Is an Important Factor. In the 1950's planning for survival during a nuclear disaster was based upon the knowledge available. A nuclear attack was seen as a real possibility but only a possibility. We had not heard of an ICBM at that time, nor had they conceived of satellites armed with nuclear warheads, whirling in space ready to fall upon their prey with very little notice. Before Sputnik, striking an enemy's territory was seen as a time consuming procedure, whereby thousands of planes would be launched and hours later reach their target. How effective they would be depended upon their number and their ability to get through enemy defenses. Under these conditions time was not as critical a factor as it has now become. Evacuation and dispersal of people could have taken place.

The launching of Sputnik by the Soviet Union in 1957 and our own satellite a year later pointed out the significance of these new "rockets." In our modern nuclear age we talk not of attacks taking a few hours but the possibility that the entire war will only last that long. There is a popular song that ends with the line "...I'll see you when the war is over, an hour and a half from now." Bombers carrying nuclear bombs would not be the prime means of carrying out a modern nuclear war. Instead, from under the ground, under the water, and out in space, today's modern missiles would fling themselves upon their enemy, taking only minutes to travel thousands of miles.

A Nuclear Rain: The Worst Disaster of All. As we realize the difficulty of trying to provide protection for people from the blast, we also realize that blast destruction would not be the major danger from nuclear war. In the event of a nuclear war it is estimated that only ten percent of the land surface of the U. S. would experience the type of destruction that is

seen in the Hiroshima picture. We might ask ourselves, why worry? Surely most of the country's population would not be affected by such blasts. This is true. But a new threat appeared on the scene during the late 1940's and early 1950's that has since made it a necessity for a different type of protection.

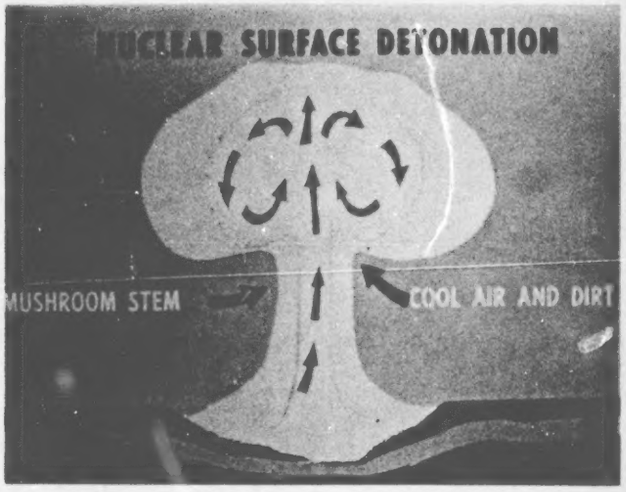
Since the first test explosion in 1944, we have known that nuclear weapons, when exploded, produce a tremendous amount of heat and blast. This destructiveness is better illustrated in visual 56. The small destructive power of the atomic bomb dropped upon Hiroshima in 1945 accomplished in one second what it took eight days of continuous bombing with conventional weapons to do at Hamburg, Germany. However, it was not until after a number of years of testing such weapons for their blast and heat effects that we began to see something more threatening to man emerge from the mushroom cloud. The new threat was -- FALLOUT.

Fallout: Radioactive Dust. When a nuclear explosion takes place on or near the ground, great quantities of pulverized earth and other debris are sucked up into the nuclear cloud (visual 57). There the radioactive gases produced by the explosion are absorbed by these debris producing radioactive particles (visual 58). Within 24 hours most of these particles will fall back to the ground as radioactive dust and sand called fallout (visual 59). The smaller particles take the longer time to reach the ground. These radioactive particles give off very dangerous invisible gamma rays -- like X rays -- which can kill or injure people as they penetrate the body in large quantities.

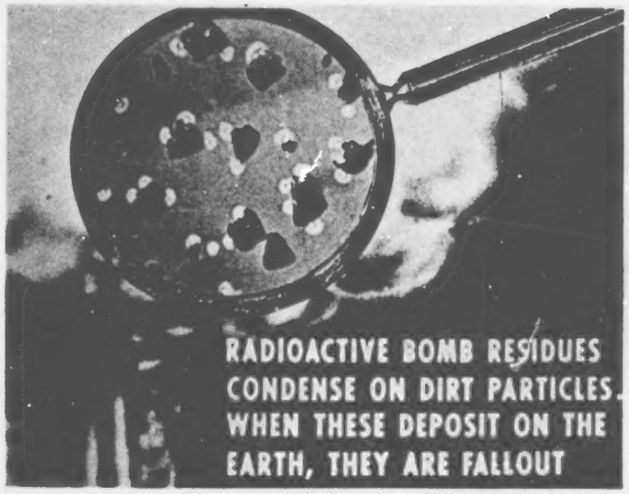
Fallout radiation causes death by destroying living cells in the body. If enough cells are destroyed in a short period of time (within four days for the average adult human being), the body will be unable to replace them and death will usually occur.

Its Effect upon Man. Where this fallout will fall to earth following a nuclear attack depends upon wind currents and weather conditions. Some areas of the country might receive a heavy accumulation while other areas would receive a light amount. No area, however, can be assured of not receiving fallout. During a nuclear war almost 70 percent of the U. S. could experience some fallout (visual 60). Fallout radiation is measured in units called "roentgens" (rent-gens). The five senses of man will not detect the presence of nuclear radiation. Some type of detection instrument is required. Different levels of radiation have varying degrees of effects upon the human body. You can see in the diagram (visual 61) these different effects. The normal person would become seriously ill if exposed to 400 roentgens and would die if exposed to 600 roentgens over a short period of time (four days). Without protection people that were exposed to such a high level of radiation over a short period of time could die. In the event of nuclear war, the radiation

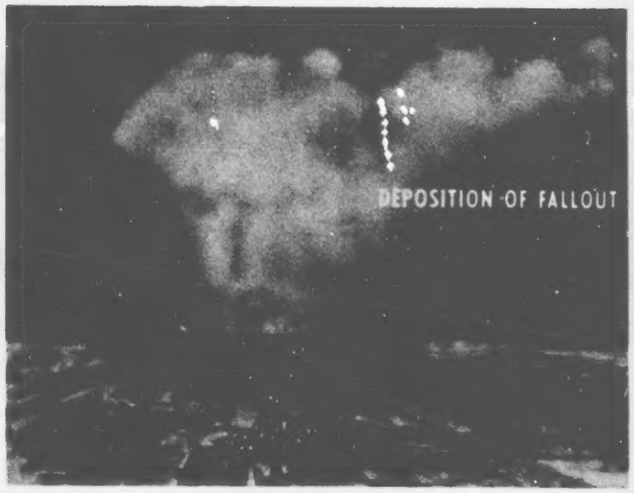
Visual 56



Visual 57

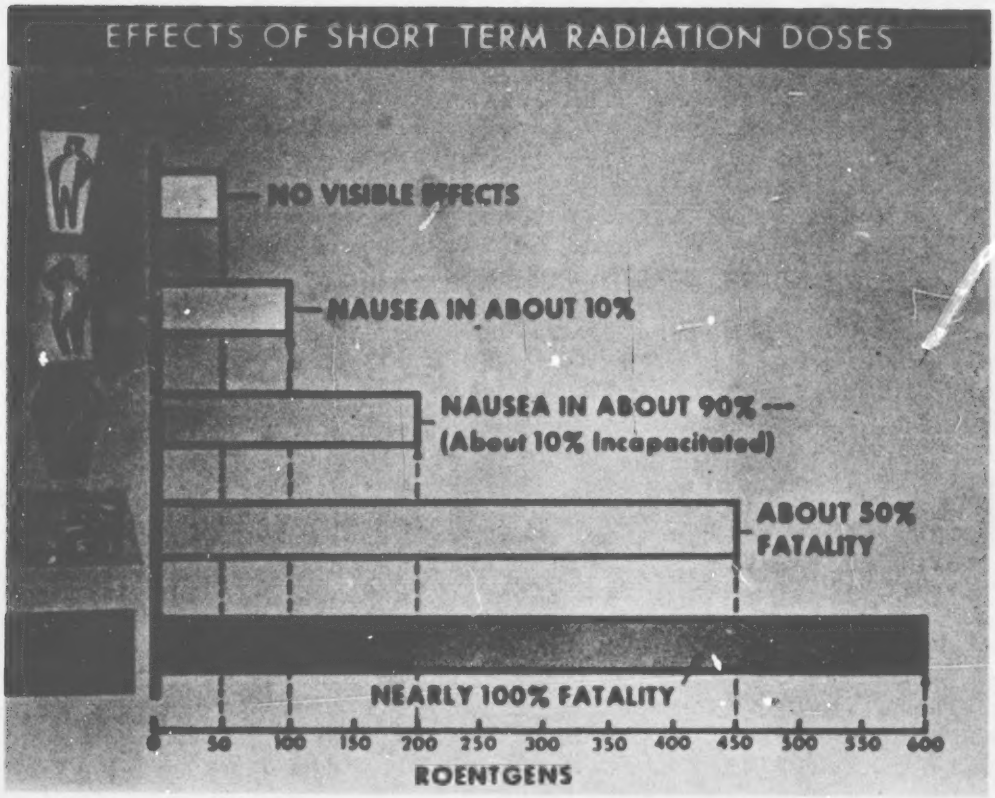


Visual 58



Visual 59

Visual 60


EFFECTS OF SHORT TERM RADIATION DOSES
NO VISIBLE EFFECTS
NAUSEA IN ABOUT 10%
NAUSEA IN ABOUT 90% —
(About 10% Incapacitated)
ABOUT 50%
FATALITY
NEARLY 100% FATALITY
0 50 100 150 200 250 300 350 400 450 500 550 600
ROENTGENS

Visual 61

level in the area of the detonation and for many miles downwind would be very high, possibly many thousands of roentgens. It is this fact that causes the greatest amount of concern today. If we are to survive, we must protect ourselves from this threat.

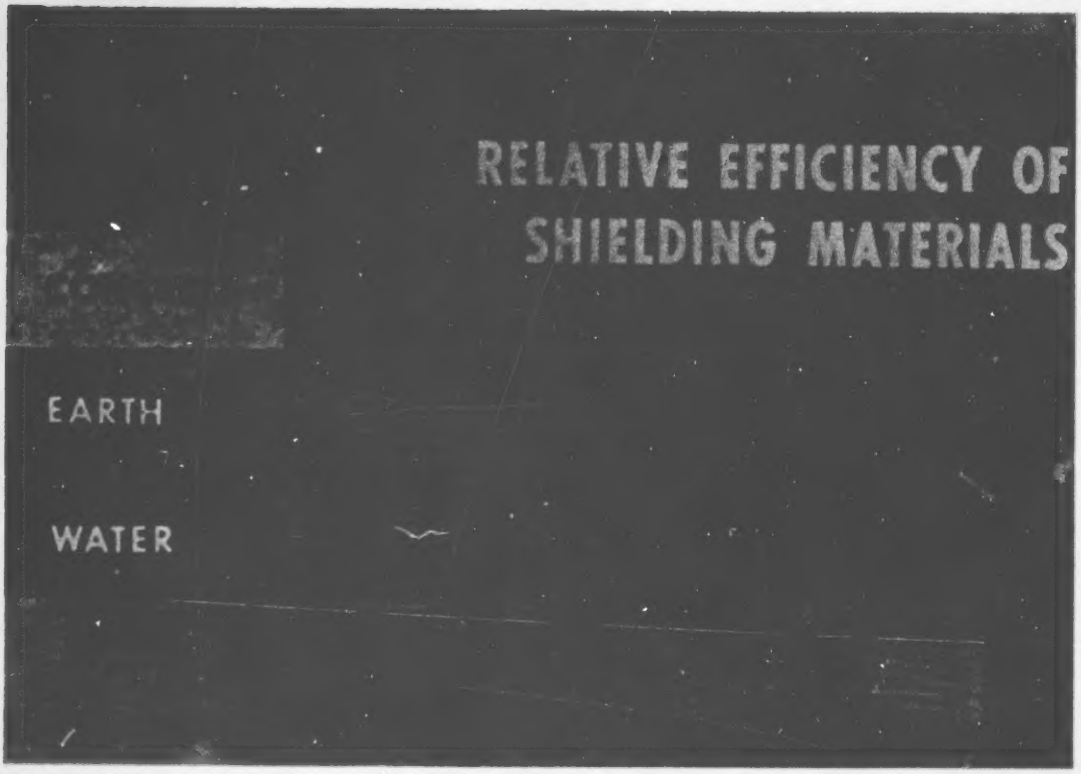
We Can Protect Ourselves. The entire surface area of the United States would be affected by fallout. Even though it is not possible to run away, it is possible to protect ourselves from its effects. Three factors play a role in this protection: time, distance, and shielding.

It is believed that the first 24 hours after fallout begins will be the most dangerous period for the people in the area exposed. It is during this period that most of the fallout would descend to the ground and the intensity of the radioactivity would be at its highest level. We can shield ourselves from this radiation if we use the right materials. Heavy materials such as concrete, steel, and earth provide excellent shielding from the penetrating gamma rays (visual 62). Thus, protection from fallout can be offered by existing buildings. This is where the more than 220 million shelter spaces identified in the National Fallout Shelter Survey were found.

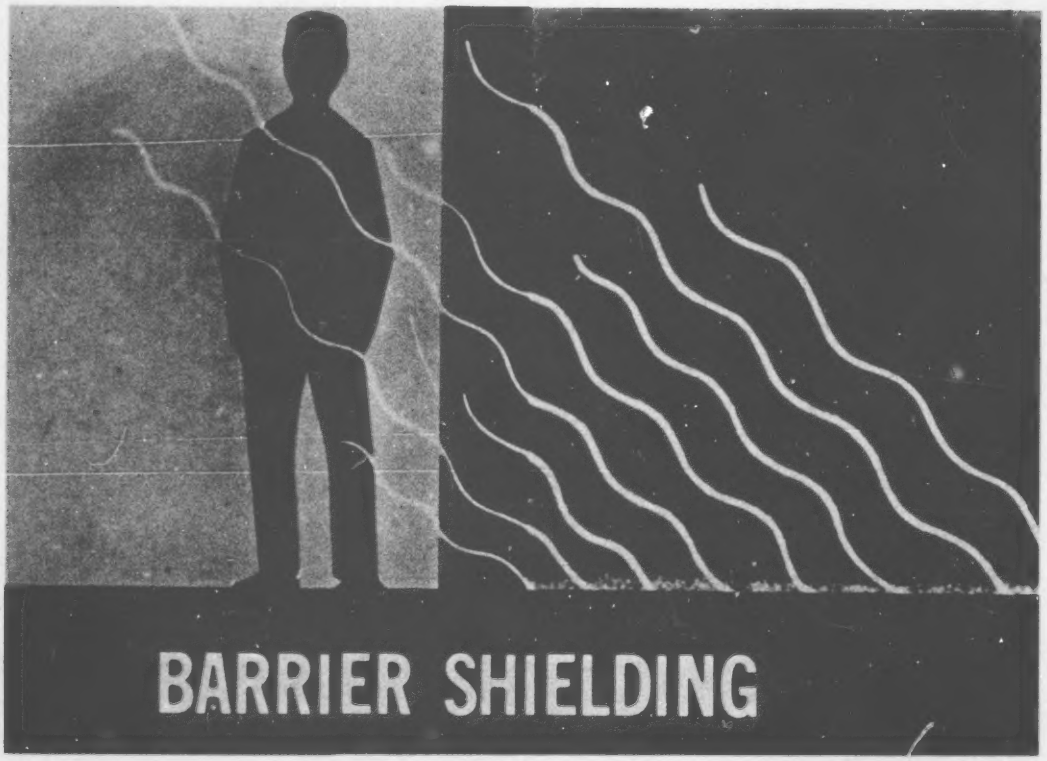
Time is an important factor when seeking protection from radiation. Radioactive fallout begins to lose its potency shortly after the detonation of the weapon. This decline in the radiation threat is called "decay." The decay is very rapid over the first few days and less over the first few months. It is anticipated that in many areas a two-week shelter stay may be necessary. Time can be utilized to our advantage when dealing with nuclear radiation. An example of the rate of decay of fallout radiation will illustrate what you can expect. An outside radiation level of 500 roentgens per hour one hour after detonation will have decayed to 50 roentgens per hour in seven hours. In 49 hours or approximately two days this radiation level would have decayed to five roentgens per hour. This has been called the seven-ten rule, a method of estimating future radiation levels. Distance is also a factor when considering the nuclear radiation problem. The further you are from the radioactive particles, the less radiation exposure you will receive. It is the radiation from the fallout particle from which we must protect ourselves. This factor was considered in designating fallout shelter areas in the National Fallout Shelter Survey.

Thus, we *can* protect ourselves against the dangers of radioactive fallout. This can be done by shielding ourselves from the effect of the radiation intensity. If adequate shielding is provided for a long enough time, the intensity of the radiation will decay to a point where it is no longer dangerous.

The particle of fallout is not in itself dangerous. The radioactive rays it gives off are what makes it so harmful to living things. The best way to shield ourselves is to block



Visual 62



Visual 63

these rays (visual 63). This can be done by placing material between the radioactive particles and ourselves (visual 64). The heavier and thicker the material the better protection it will provide.

In our description of how we can protect ourselves from the dangers of fallout we did *not* state that such "fallout shelters" have to be a special type of building or underground bunker. Such special buildings can, of course, be built. Private home shelters are special buildings that can provide such necessary protection.

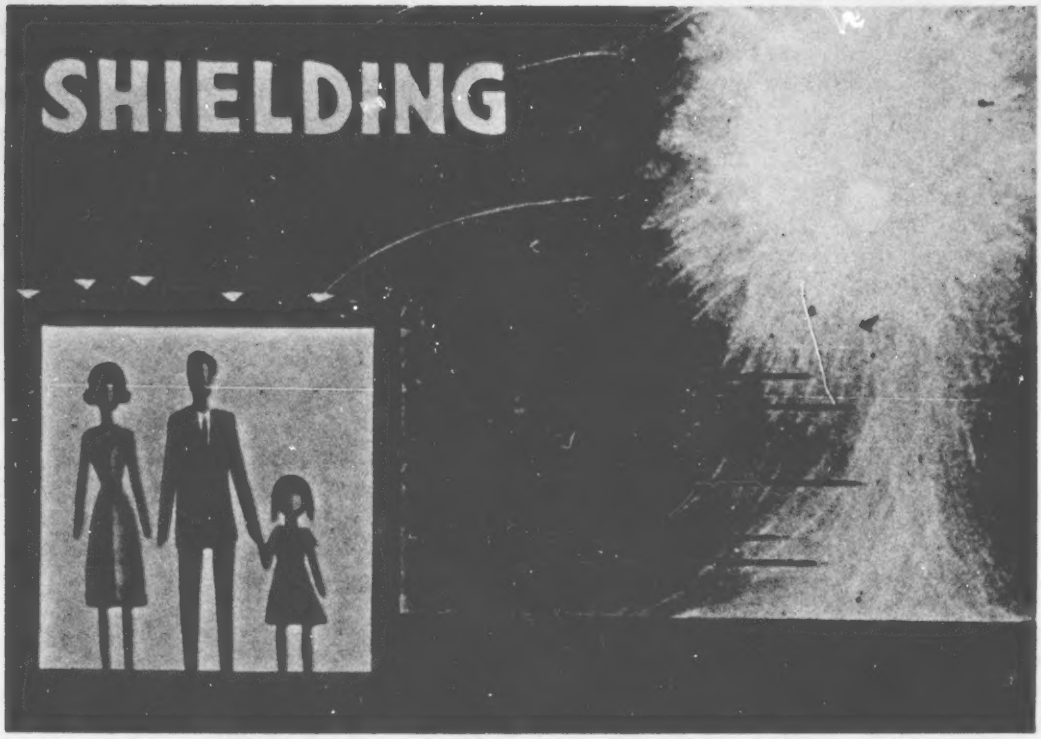
It is now realized the protection from fallout can be offered by existing space, provided the walls and roof are thick and heavy enough to absorb and block most of the rays given off by the radioactive particles. A shelter can be the basement or inner corridor of any large building (visual 65). A subway or tunnel, the basement of a private home, or a bathroom in the middle of your home can offer some protection. In fact almost all such structures offer a certain degree of protection. Even your school might be included.

The important thing to remember is that the best protection is offered by those buildings constructed with the heavier, thicker material. A building that uses steel, concrete, or other such materials in its construction offers greater shielding than a building constructed out of wood.

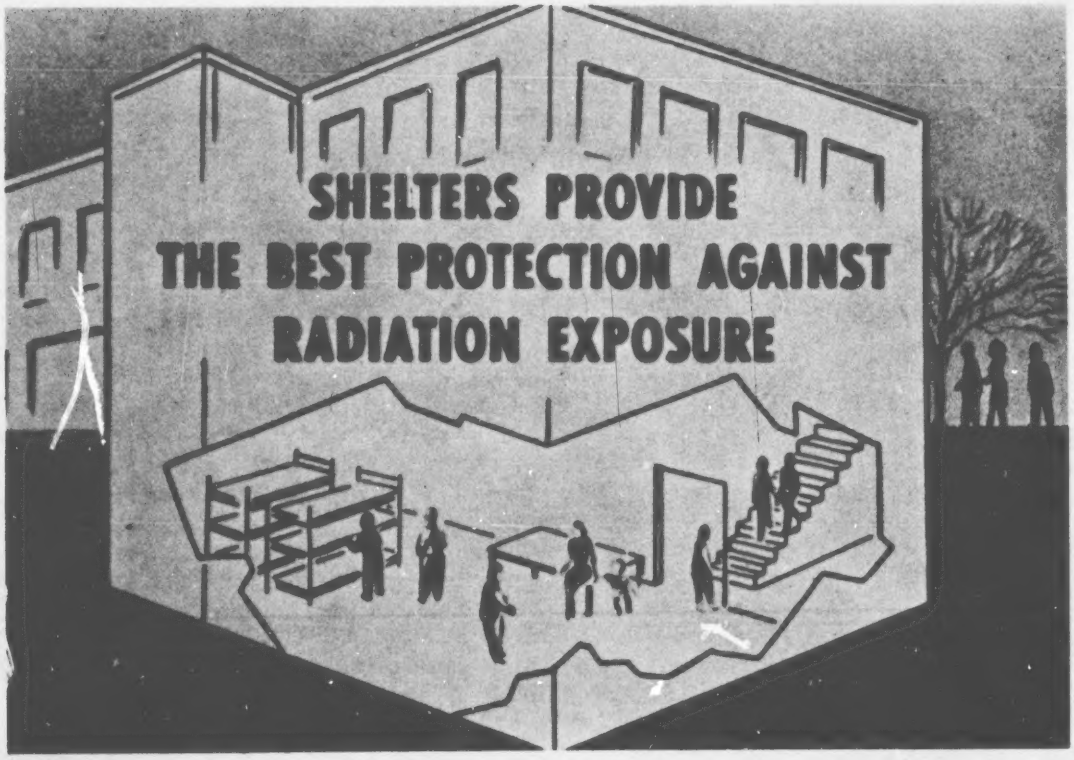
The National Shelter Plan. Providing such shelter space for all persons wherever they may be any hour of the day or night -- at work, at school, at home -- is the key emphasis of the Defense Civil Preparedness Agency and its National Fallout Shelter Program. This National Fallout Shelter Program has been developing over the years to achieve this goal.

The basic aspects of the program are locating and identifying potential mass shelter spaces that exist in buildings and other structures and educating the average citizen as to how he can build his own personal or home shelter for protection. It is hoped that through both of these procedures enough shelter space will be available to provide adequate protection for all the people in the U. S.

The Initial Step: Finding Shelters. In September, 1961, a nationwide survey of existing buildings was started to locate potential public fallout shelter space. This survey was conducted under the direction of the Office of Civil Defense (now the Defense Civil Preparedness Agency). By 1963, thanks to the added push given it by the Cuban missile crisis of a year earlier, much of this initial survey had been completed. Even though a large part of the population could be accommodated in fallout shelter space existing in old buildings, not all the shelters were located in the right places or with the right number of spaces. A continuing survey has since been conducted on all new buildings and structures to identify spaces that will



Visual 64



Visual 65

provide protection. By February, 1966, more than 161,000 such structures had been located and identified. These structures offered a combined total of 141,500,000 shelter spaces. By March, 1975, the number of shelter spaces located had reached 220 million.

Many of the public fallout shelters identified to date are located in the downtown areas of large cities and are therefore not easily accessible to many people, especially at night. There is some shelter in the suburbs and a considerable amount in the basements of private homes in certain parts of the country. But in most areas there is not enough shelter for all persons wherever they may be at any time of the day or night.

New Shelters. To increase the amount of shelter space available, the Defense Civil Preparedness Agency administers a nationwide shelter development program. Its aim is to encourage and aid architects and consulting engineers to include fallout shelter space in the design of new buildings and thus increase the national shelter inventory.

Many of the new school buildings being constructed around the country are designed with this purpose in mind. Blackwell Senior High School, Blackwell, Oklahoma, is such a structure. Not only are they built to provide fallout shelter protection but also to provide much needed tornado and severe storm protection. Bradshaw High School in Florence, Alabama, is one of these new schools. Is your school so designed?

Thus, new fallout shelter spaces, meeting minimum standards, are being created all the time. An additional six million spaces are expected to be located each year from new construction and improvements in existing structures. Can you locate the buildings in your areas that serve or could serve as shelters in time of emergency?

Know Where They Are! A basic problem to this shelter survey program does exist. All the shelters in the world would be of little use if the people -- you, your mother, father, sister, and brother -- did not know where they were and did not use them. This is another aspect of the National Fallout Shelter Program.

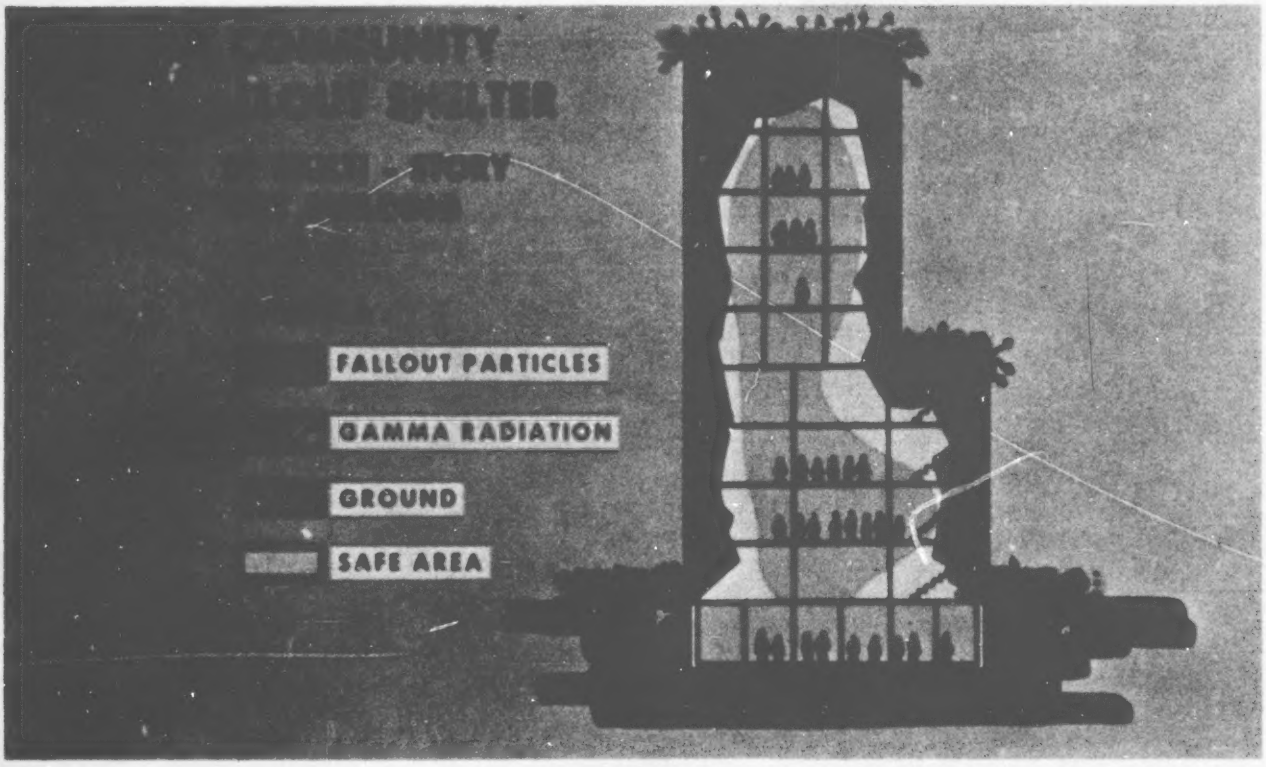
Once a building has been located which offers the required amount of fallout protection, that building is marked so that the people will be aware of it. Practically everyone today has seen the sign that designates a particular building a fallout shelter. Anyone who has ever entered buildings in downtown areas or possibly some of our most modern schools has seen the familiar yellow triangles in the black circle that signified that building as having fallout shelter protection within it (visual 66). Any building boasting such a marking has met certain minimum requirements of protection. These requirements include (1) a minimum fallout protection factor (PF) of 40; (2) space for at least 50 people, each having ten square feet of room; and (3) adequate ventilation. Only after meeting

FALLOUT SHELTER
IDENTIFICATION

PUBLIC FALLOUT SHELTERS IDENTIFIED IN THE DEPARTMENT OF DEFENSE FALLOUT SHELTER SURVEY WILL BE MARKED WITH THIS DISTINCTIVE BLACK AND YELLOW SIGN.

PROTECTION AFFORDED BY EXISTING STRUCTURES MARKED FALLOUT SHELTERS PROVIDES SAFETY FOR OCCUPANTS FROM RADIATION EFFECTS OF FALLOUT FOLLOWING A NUCLEAR DETONATION.

Visual 66



Visual 67

these requirements are buildings, tunnels, caves, etc., considered usable as fallout shelters. It should be pointed out that the owner of a building must consent to its use as a shelter before it can be designated as such. The owner offers the space free of charge.

The Answer Lies in Your Community Shelters. The heart of the program is the concept of *local* public or community shelters. Such a system of shelters is seen as essential to emergency readiness both local and national. The local community and its governing bodies hold the prime responsibility for making this program an effective system of protection. The basic tenet of the entire civil defense concept stresses this idea -- that civil defense is by law a joint responsibility of the federal, state, and local governments. Each has a distinctive and complementary role. At the same time it is recognized that the *local community* is where the action is -- where lives are lost or saved during a disaster. How well has your community performed its role? For most of the population such public shelters provide the best answer to fallout protection.

A typical public shelter in any community might resemble the diagram of the building in visual 67. In such a building protection from fallout is offered in a number of places. The center rooms of the building offer greater protection than the outer ones because you are farther away from the radioactive particles and there is a greater amount of material (walls) between you and the radiation. The basement of such a building would allow even greater fallout protection because of the added protection of many floors of material above you and concrete and earth around you. However, the central core of the building would still offer a considerable amount of protection.

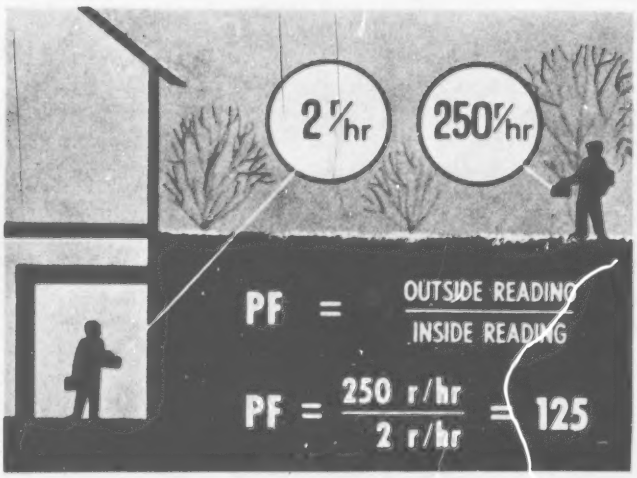
Public shelters are also found in such places as the subway system of New York. Many caves are also to be used as public shelters. Cathedral Caverns near Grant, Alabama, is planned for use as a public shelter in the event of a nuclear war. A series of caves located near Anderson, Tennessee, provides shelter space for some 15,000 Tennesseans in the area plus some 25,000 Jackson County Alabamians. Many of these caves have been stocked with supplies.

Public shelters offer many advantages. Most of the public shelters in the U. S. today have been stocked by the federal government with the minimum of supplies that would be needed (visuals 68, 69, and 70). These include food (survival crackers), water (one quart per person per day), medical supplies, sanitation kits, and radiation detection equipment for use inside the shelter. This minimum amount is based upon a shelter stay of two weeks. After considerable research in this area concerning the time needed for the intensity of the radiation to decline (decay) to a safe level, a two-week stay has been estimated to be the minimum time needed. All marked public shelters also offer at least a minimum protection factor of 40. This means that a radiation level of 250 roentgens per hour outside would produce a reading of two roentgens per hour inside if the

Visual 68

Visual 69

Visual 70



Visual 71

shelter protection factor were 125 (visual 71).

In addition to these advantages, as a member of a group, a person may find that he is better able to face the problems involved in a two-week shelter stay, both physical and psychological. You could expect to find in a public shelter many people with desired skills that would not be available in private home shelters. The Defense Civil Preparedness Agency has programs for the training of personnel to staff these public shelters and serve as leaders (managers) in them. Thus, the chance of better organized activity and better understanding of the problem you will face can be found within a public shelter. There might also be experts in other areas, such as doctors, who could be of service to you.

Probably one of the best advantages of public shelters lies in the area of human companionship. During times of stress and sorrow, the fact that other people are also sharing your problems often enables people to endure severe hardships. In a public shelter you would have many people with you.

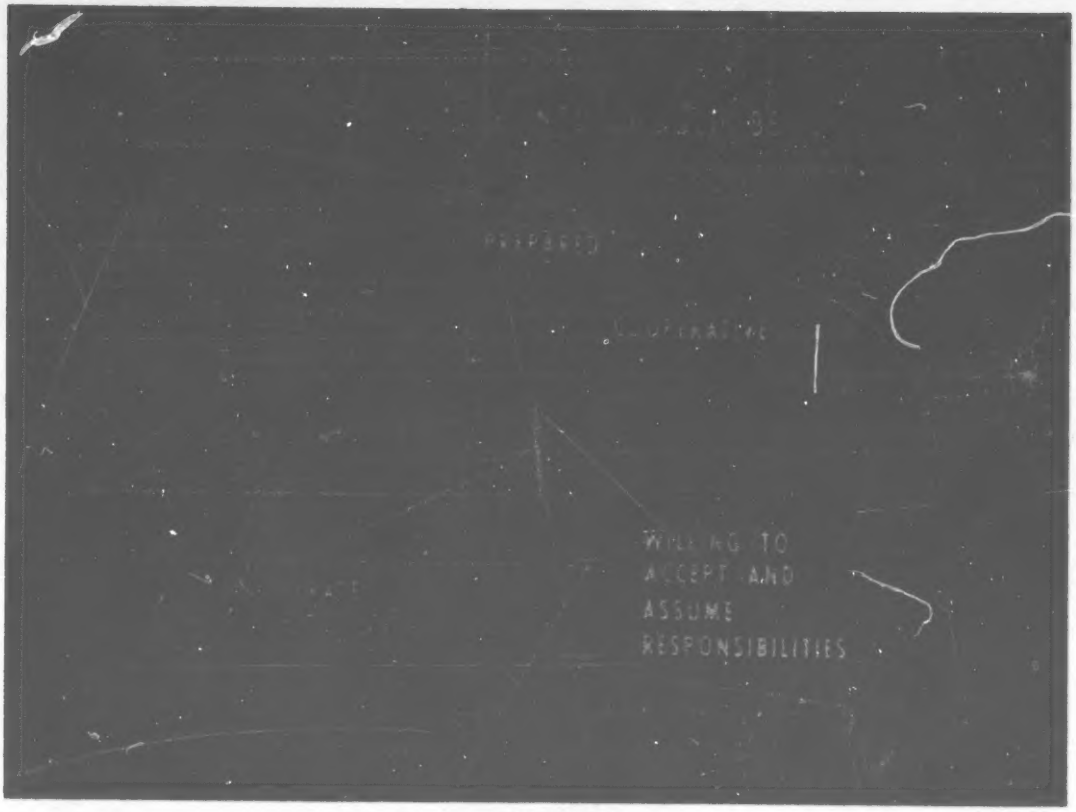
Public shelters do, of course, possess some disadvantages. Federally stocked supplies in the shelter will be at a bare minimum. The amount of water, "survival crackers," and sanitation equipment are not very conducive to gaining weight. It would be a tough time for all. Medical supplies would be available but only on a limited scale. There would be no special medicines which may be required by some individuals (medicines for diabetes, heart disease, etc.) Should more people occupy the shelter than it was supplied for and should additional supplies not be available, then rationing would have to be used.

From a psychological standpoint, the normal stresses among people who find themselves in unfamiliar situations would possibly produce problems of behavior among some of the people in the shelter. The proper attitude of shelter occupants is very important during this stay (visual 72). This is where the value of a shelter manager will come into play. One of his main responsibilities will be the maintenance of proper shelter attitude and behavior.

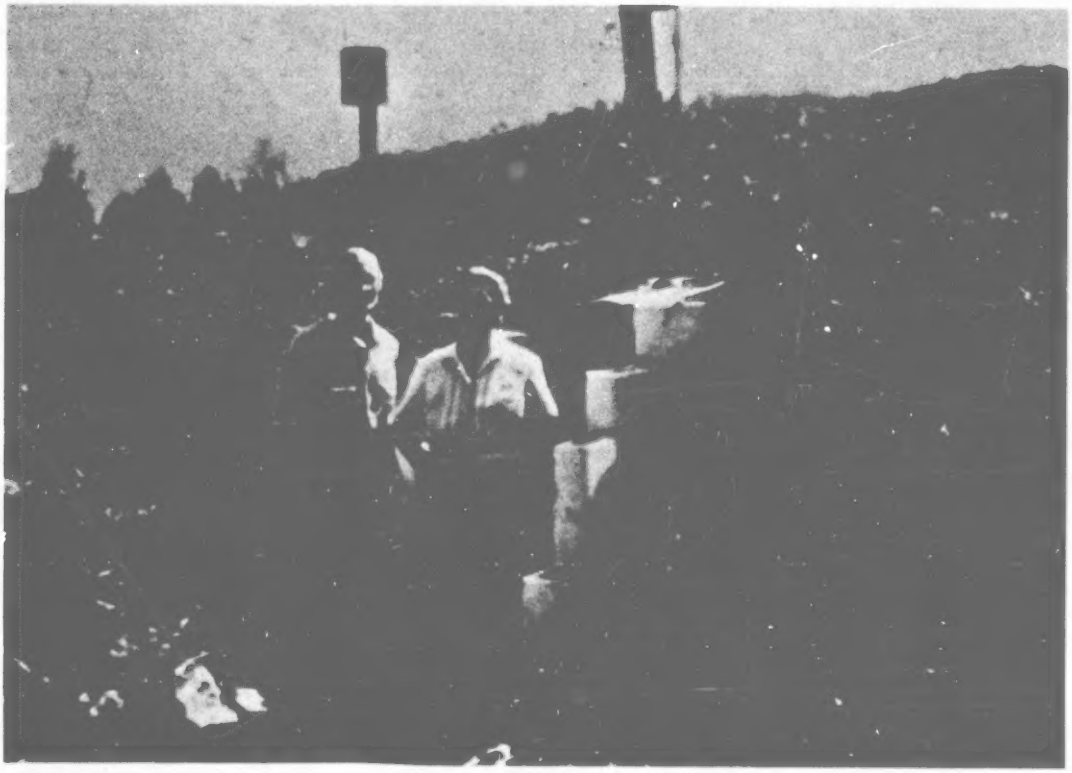
Personal hygiene would be a problem due to the proximity of people. Privacy would be considerably limited.

Even though there could be some problems in public shelters, generally speaking, the advantages far outweigh the disadvantages. This is especially true for those people who have no personal home shelter, or if they do, no time to get to it.

Home Shelters: A Desirable Asset. The National Fallout Shelter Program also tries to encourage the construction of home shelters by individuals. Several states have passed legislation to provide tax relief to persons and firms including fallout shelter protection in buildings built or owned by them. The obvious reason is that it increases the number of shelter



Visual 72



Visual 73

81

spaces for protecting the people, and it also makes shelters available to those people who are at home in the event of a nuclear attack. Private shelters can also be utilized as protection against certain natural disasters such as tornadoes. In fact, many people have adapted their original "storm" shelters to serve as fallout shelters as well (visual 73).

There are some basic advantages of a home shelter. In a private shelter the only limiting factor for the amount of food supplies is the space available in which to store it. "Survival crackers" or limitation of water supplies need not exist in a private shelter. You can stock your shelter with as much food (so long as it doesn't require cooking or refrigerating, of course) and water as you want. You should keep in mind, however, that you will need more than just food and water in the shelter. Many additional items should be included in order to give you the best possible chance for survival.

The amount of privacy and comfort of a home shelter is also up to the individual. Only your immediate family would stay in the shelter; thus you need not worry about strangers or their behavior.

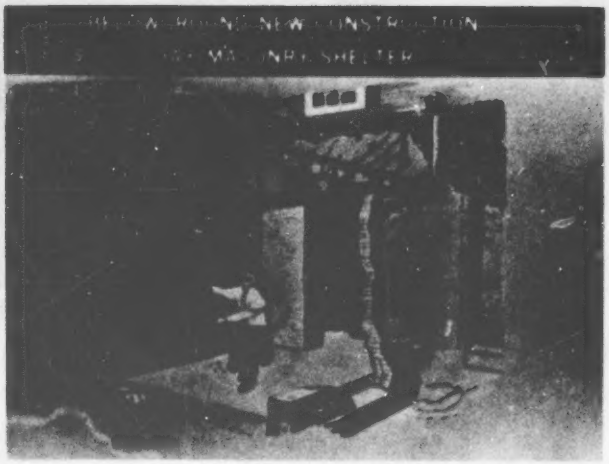
Even with these advantages we must also see that some obvious disadvantages exist. First and foremost is the question of how much protection from radiation your home shelter offers. Will it have a "protection factor" of at least 40? In building a home shelter you should be careful in constructing it to be sure it can meet this requirement. An advantage related to this is that with a little knowledge of what is needed you can increase the protection factor of a private shelter above that of a public one. Another disadvantage comes from the lack of specially skilled individuals -- doctors -- who might be found in a public fallout shelter.

It is to your advantage to have a home shelter, however, even with the disadvantages mentioned above, for it will be convenient for use in all types of emergencies.

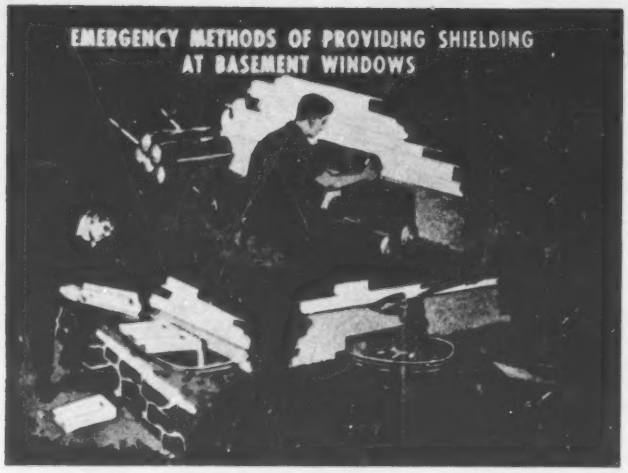
Some examples of the types of home shelters that have been built for use are seen in visuals 74 and 75. Note that if you have a basement under your home, half the battle has already been won. The basement itself offers considerable protection. It would simply be a matter of walling off an area with the right materials and providing additional protection overhead to have an adequate shelter.

Your local civil defense office has available a considerable amount of information with regard to building and stocking shelters. They will be willing to offer all the aid possible in helping you learn about fallout shelters. They are also the prime source for any other information concerning disaster preparedness, both natural and nuclear.

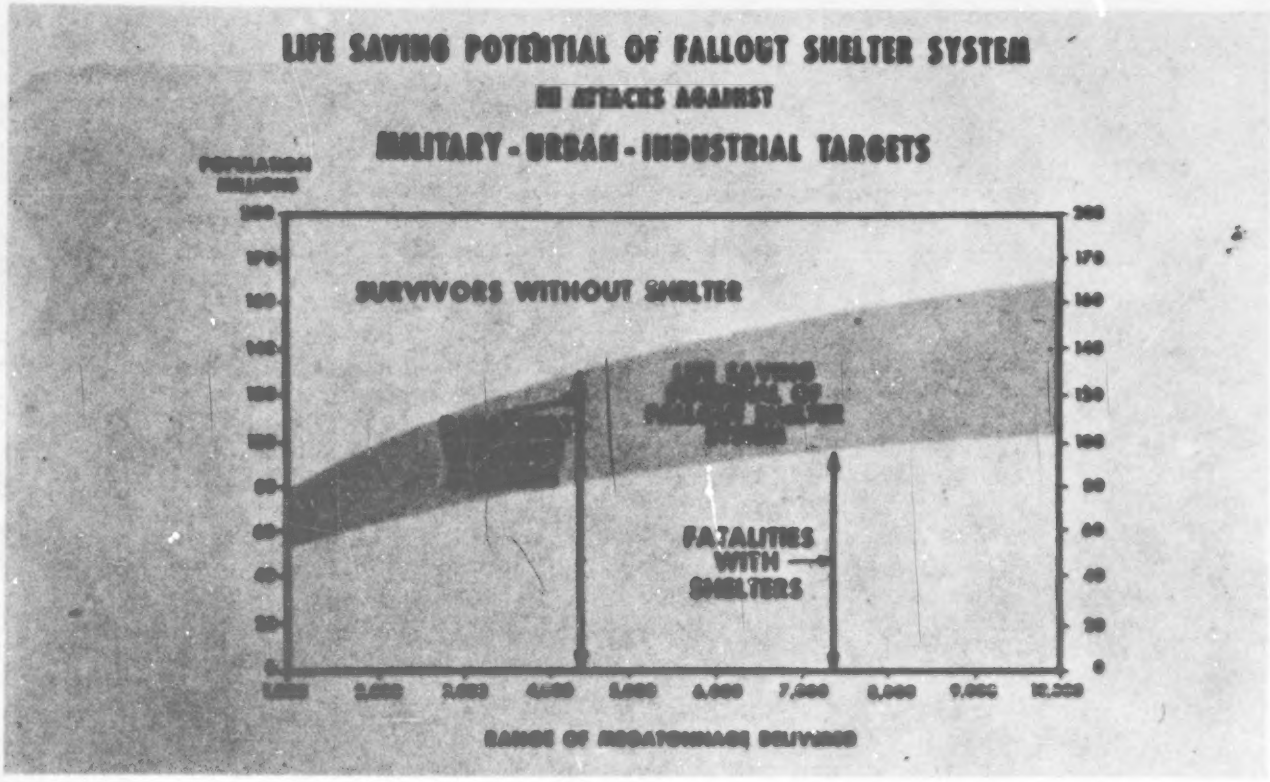
We have stressed up to this point that fallout shelters



Visual 74



Visual 75



Visual 76

would enable us to survive a nuclear disaster. But we still might ask just how effective such a shelter system would be. National priorities and strategy could dictate a change in emphasis -- possibly a system of blast shelters as well as fallout shelters. The graph (visual 76) illustrates the number of lives that could be saved through a National Shelter Plan. Numbers are very cold and meaningless to most of us, but when we think of them in terms of individual human beings -- you, your friends, your family -- they then become very important to us.

New Program Elements. Defense Civil Preparedness Agency has expanded the range of protection options to the American people through several new programs. These include: (1) a redirected and streamlined shelter survey, to identify best-available blast protection in higher-risk areas; this survey is also designed to identify protection from various peacetime disaster effects; (2) community shelter planning in higher risk areas that emphasizes use of best-available protection against direct effects (blast, fire, initial nuclear radiation); (3) contingency planning for relocation of population from higher-risk areas during periods of intense international crisis.

In chapter three you will study civil defense in other nations. An expanded Soviet Civil Defense Program provides for the evacuation of certain citizens from the major population and industrial areas. The United States Government must have similar options to meet challenges by other nations.

These new program elements developed by DCPA are designed to complement, not replace, existing plans for the sheltering of the population. Chapter four contains additional information about Crisis Relocation. Plans affecting your area will be made available to the public as the necessity arises.

The preparation of a nationwide fallout shelter system is the best possible safeguard we could have against the total destruction of our people during a nuclear disaster. It possesses the life-saving capability required during such an emergency. The shelter system is not the only aspect of the "survival" program. True, it is the key element. But it could not properly function without the assistance of a number of other programs that are part of the overall program objective -- the survival and recovery of our nation from a nuclear holocaust. These additional parts of the Civil Preparedness Program deal with *warning and emergence.*

Civil Defense Warning System. One of the essential supporting systems of the National Fallout Shelter Program is the National Attack Warning System. For people to receive the maximum benefit from the fallout shelter system, they must receive timely warning of an attack so that they can move to the best shelter protection available. As nations have developed more advanced means of striking an enemy, this warning time has steadily decreased. Thus, we need every second we can get.

The present Civil Defense Warning System is like the entire Civil Defense Program itself, a combination of federal, state, and local systems. Federal warning systems are designed to pass warning information to strategic points within each state. The state and local governments are then responsible for warning the public. Using advanced techniques of communication, this system interconnects federal, state, and local systems into a single warning network (visual 77).

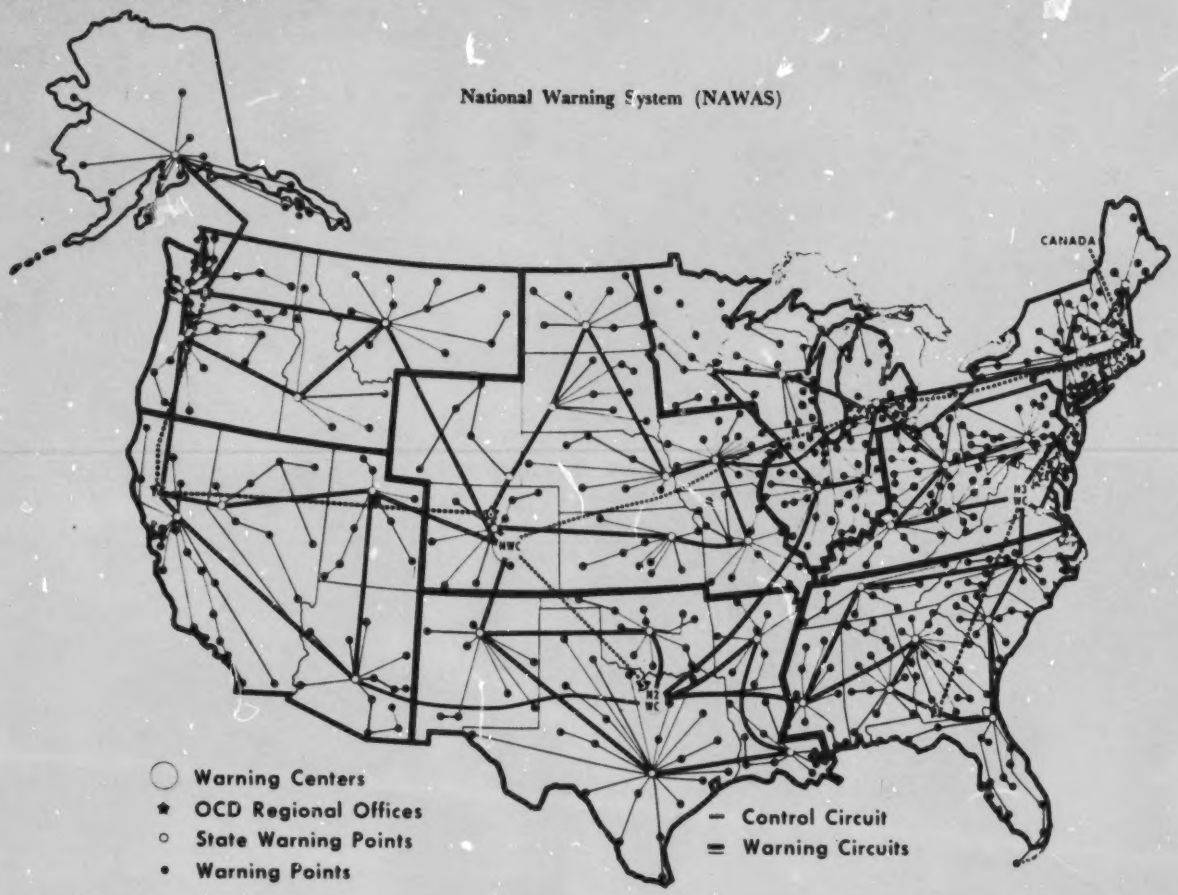
The central core of this warning network is the federal warning system known as NAWAS (National Warning System). Almost instantaneous attack warning can be provided to all the states from its three warning centers located throughout the country. These include centers at Denton, Texas, and Washington, D. C. The main center is located in Cheyenne Mountain, Colorado Springs, Colorado. Inside this mountain is a huge hollowed-out cavern containing a number of multistory buildings. These buildings are actually built on top of giant springs to absorb the shock waves of a nuclear explosion striking nearby. It is in these buildings that the main coordination and control of the entire military defensive capability of the U. S. are handled. It is also from this center that attack warnings are received and sent to some 1,700 warning points throughout the 48 adjacent states. Hawaii and Alaska receive their warning by means other than NAWAS. Warnings are then sent from these points to the total population of the United States by many different means.

Basic to this warning system is the detection of an attack upon the U. S. This is provided through a joint United States-Canada defense system, the North American Air Defense Command, and a system of surveillance satellites.

Radar stations are located throughout the U. S., Canada, and the Arctic Circle. This gigantic system of radar sites exists to provide detection of an attack upon the North American Continent by both planes and missiles. In addition the Samos "eye-in-the-sky" satellite system maintains a constant watch on entire hemispheres of the earth. They are able to detect the launching of an enemy missile at the moment its engines ignite. Thus, we are able through the detection system to provide immediate warning should a nuclear attack occur. The ten to fifteen minutes warning time thus provided does not compare to the hours we would have had in the pre-missile age, but even this short period is better than nothing at all. If it is understood and used by the public properly, we will be able to save additional tens of millions of lives. Who would want to do otherwise?

The question now arises as to what happens when the warning is issued? There are many methods available to inform the public to seek shelter. All of them will be used. Television and radio stations will broadcast the warning and then go off the air. Certain designated stations will continue to transmit, however, in order to pass information from local, state, and

National Warning System (NAWAS)



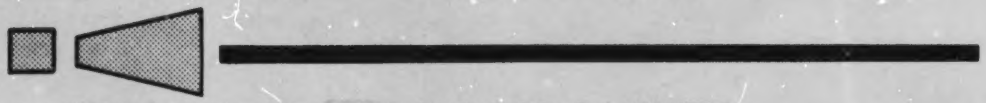
Visual 77

Civil Defense Warning and Alert Signals

THE ATTACK WARNING SIGNAL

A WAVERING TONE OR SHORT BLASTS FOR 3 TO 5 MINUTES -- ACTUAL ATTACK AGAINST THIS COUNTRY HAS BEEN DETECTED -- TAKE PROTECTIVE ACTION IMMEDIATELY !

THE ATTENTION OR ALERT SIGNAL



A STEADY BLAST OR TONE FOR 3 TO 5 MINUTES -- LISTEN FOR ESSENTIAL EMERGENCY INFORMATION !

Visual 78

even the national government along to the public. This is the *Emergency Broadcast System*. Police and firemen will use their communication and siren equipment to inform the public of the need to seek shelter. Many communities have "special" siren systems that will allow them to sound a warning over a wide area. Does your community have this system? If so, where are the sirens located?

The siren is the preferred common outdoor warning device. Should your community possess such a system, learn its signals so that you will know when and what action to take. There are two basic signals -- alert and attack (warning). The *attention or alert signal* is a steady blast or tone for three to five minutes. It is used primarily for peacetime emergencies and means that you should listen for essential emergency information. This information may either be provided over the radio and television or over the siren sound system itself.

The *attack warning signal* is a wavering tone or short blasts for three to five minutes, and it means that an actual military attack has been detected. If you hear such a signal, you should take protective (fallout shelter) action immediately (visual 78).

Emergence and Recovery. We have pointed out in the preceding sections of this chapter the destructive potential of nuclear weapons and the dangers from fallout that would result from the use of such weapons. We have also emphasized the steps we as individuals should take in order that we might survive such a catastrophe. We must now look at what will come after such a nuclear war.

As the radioactive level decays, it will be possible to begin emerging from our shelter. As time goes on, these brief first trips will develop into permanent ones. At this point we will begin to consider the recovery operation. We must look around us. What will life be like? How much of the old will remain? How different will it be?

One thing is for certain -- there will have to be a tremendous amount of readjustment by each one of us. Life will definitely not be that to which we have been accustomed. There will probably be no late movies on television. We may not be able to take the family car to the movies, to get a milkshake, or to take a quiet drive with our girl or boyfriend. Collecting records or wearing the latest "mod" fashions may have to cease. There probably won't be any more records (or power to spare to play any old ones we might have), and the clothes we are now wearing might have to suffice for a long, long time. Remember how warm and loving "Ruffles," your pet dog, was two weeks ago? There probably will not be many pets should a nuclear war occur. In fact it will probably be a rare occasion when you will see a wild bird spread his wings in flight across the sunlit sky.

Sounds very bleak, does it not? That is the way it may very well be. We need to become aware of this fact before and not

after it happens. Only by learning about it now and understanding the tremendous tragedies involved will we know that the *better* path to survival lies in preventing it from happening. The world must acquire a spirit of understanding and cooperation, of friendship, and trust if we are going to live on this big marble ball we call the earth.

But let us look again at survival. We have *not* said in our description above that people would not survive. Our emphasis in this section has been on just the opposite. We have stressed again and again that people *will survive*. We have shown the means available and the methods by which such survival can be realized. What we have said, however, is that this survival will not be fun and games we were familiar with as children. It will be very difficult. There will be severe hardships. There will also be much sorrow and pain. But human beings have triumphed in the face of disaster in the past and they will continue to do so. Life will not be the same, but it will still be *life*.

Survival and recovery following such a disaster will not depend solely on the individual. As we saw in the natural disaster section of this text, plans exist for and organizations are ready to aid the victims. There are elaborate plans and preparations for relief to people following a nuclear disaster as well. We will not be alone as we attempt to recover. What are these organizations and plans? Where can they be found? Let us look around. Part of them can be found in our everyday way of life. Our local and state governments, in cooperation with federal agencies, have established plans and procedures whereby necessary aid can be provided to those people in need. Governments have plans to assure that all citizens get an equitable share of available resources to meet their needs. Public shelters might remain open to provide housing. Food and water supplies will be controlled and checked by local government and civil defense authorities to insure both its availability and its safeness. Rationing, if needed, will be handled by these different agencies.

Immediate attention will also be given to restoring vital public services: food distribution, sanitation, public utilities for power and medical facilities. Government will also be vitally concerned with the preservation of law and order following such a disaster. Not only will existing law enforcement agencies be used, but the National Guard and even the army will play a role in this effort (visual 79).

Do not, however, get the idea that following such a nuclear disaster or any type of disaster for that matter that the national government will come riding over the hill -- as a big brother -- to magically wash away all your problems. This simply is not the case. The Federal Government will play a vital role in restoration, but more in the area of coordinating the use of the resources of the nation, assisting *local*

Visual 79

organizations in using these resources, and in keeping the public informed (Emergency Broadcasting System). The main concept of the overall Civil Preparedness Plan for the U. S. in the event of a nuclear war is "self-sufficiency." Civil preparedness stresses local and state preparedness and local action to withstand a disaster and recover following it. Thus, we might say that the real concept of civil preparedness is the concept of the individual human being with his own knowledge and effort in cooperation with the people and agencies surrounding him providing for his own survival and recovery. If you as an individual look upon this with the awareness and understanding required, *it will work.*

CHAPTER THREE

CIVIL PREPAREDNESS IN OTHER NATIONS

Introduction

As a means of comparing what we have done and are doing in civil preparedness with that of some other countries, a brief summary of what they have done is given below. As you will notice, some countries require that the entire population take courses in civil preparedness training and participate in other civil preparedness activities.

Cuba

The civil preparedness program in Cuba is centered around the use of underground shelters. Most of Cuba's shelters are found in existing caves and tunnels. Others have been dug for that purpose. There are more than 3,000 caves and tunnels that have already been made ready for use in the event of a nuclear war.

Some provinces of Cuba have constructed underground hospitals that, in all probability, could continue to operate during and after a nuclear attack. They also have other underground facilities either under construction or in the planning stage.

Switzerland

Although Switzerland is traditionally neutral when her neighbors are at war, the Swiss people have developed a fine shelter program for their protection in the event of a nuclear war. Their shelters are of two types. One type is for the civilian population. These are deep caves that have been made livable and stocked with food and other things necessary for shelter living. The fabricated military shelter constructed like modular storm pipes is the second type of shelter. These shelters have leak-proof doors and contain such supplies as food and furniture. They are made in sections so that several can be connected together to accommodate large groups of military personnel.

Egypt

Egypt's civil preparedness is also centered around a shelter program. They are now in the process of stocking their shelters with the most advanced supplies. Elaborate equipment is provided in each shelter. Mobile medical teams have been trained and provided with the most modern treatment techniques to be used in shelter living.

Israel

The people of Israel have developed a civil preparedness organization capable of operating at peak efficiency during emergencies. Their name for civil preparedness is Haga. Both men and women are required to serve in the organization. Haga members serve within a public commission commanded by the Haga Chief who has the rank of Colonel. Local commanders and commissioners are responsible for Haga in the districts and towns of Israel. Their primary concern is survival during and after conventional warfare.

Some Haga groups learn emergency first aid techniques. They are responsible for treating the wounded after attack. Many of their activities involve actual experiences rather than merely studying first aid from textbooks. Other groups learn such activities as how to inspect factories, schools, and homes to determine the extent of damage.

The Netherlands

In the Netherlands each citizen must, in his own interest, take the required measures for his own protection. These are:

1. Limit fire hazards by eliminating all flammable objects (clearing of attics, etc.).

2. Acquire simple fire-fighting equipment to fight incendiary bombs and small fires, and have first aid kits on hand for treatment of wounds.

3. Build and furnish shelters appropriate for protection from radioactive fallout.

The block chiefs in the cities shall inform the public on the possibilities of self-protection and encourage individuals to take these measures.

The block chief is mainly the link between the public and the local civil preparedness organization. In larger cities about 1,000 inhabitants form a block. The block command consists of the block chief and four assistants, one of which is the adjutant of the block chief. Each group of four or five blocks has a communications center and two telephone operators at its disposal. In smaller towns each block is comprised of not more than 2,000 inhabitants.

For every 250 inhabitants there is one block assistant. In larger cities the blocks are grouped in sectors. The main task of the sector command is to organize relief activity in its own sector and, if necessary, in other sectors as well. Each sector is responsible for about 15,000 inhabitants. The chief of each sector has two deputies (one for the health service and one for the rescue service). Each sector has a health and rescue service, the latter also being in charge of fire-fighting. In peacetime these services are composed of 20 men.

In wartime each service is reinforced with 44 voluntary helpers.

Denmark

With regard to disaster rescue, Denmark's well-developed civil preparedness program is of great importance. It has organized a Relief Service in order to save lives and property by direct intervention in disaster areas. This service includes, first of all, a rescue unit to rescue the wounded from ruins, ambulance units to deliver the wounded to hospitals, a fire-fighting unit to control and extinguish fires, and a welfare service to care for homeless people. In addition, evacuation, technical, and water-transportation units, as well as many other special units, are also included in this relief service.

Three so-called "lines of operation" are differentiated in this relief structure. The first line of operation is formed by self-protection. Its job is to limit the extent of light local damage by using simple means and the help of all able-bodied civilians. The local Relief Service directs the second line of operation; that is, the service units which are responsible to the local authorities of the individual cities, such as the fire brigade, rescue teams, welfare service, etc. Finally, the third line of operation is handled by long-distance rescue units which can be called for wide-spread disasters. Some are from other cities, some from the National Civil Defense Corps which has at its disposal well-equipped rescue teams and specially trained personnel.

Austria

In Austria each year 40,000 soldiers will receive instruction on the need for civil defense, with special emphasis on self-protection. They are encouraged to spread the ideas of civil defense among the population after their nine months of compulsory service. The Federal Ministry for National Defense requested the Austrian Civil Defense Union to launch this campaign for the purpose of informing the public.

Anticipating that shelter construction may soon be required by law, numerous shelters have already been built in Upper Austria.

China

The Civil Defense Program in China is developed around the use of huge underground tunnels to protect the population. These tunnels are mostly in the larger cities. Many stores and shops contain entrances to these tunnels. The tunnels are stocked with food, medical supplies, and other items that would be needed in the event of a nuclear war.

Most of the industries, factories, and small plants which manufacture much of China's products have been scattered throughout the country. This makes it almost impossible to destroy any

particular industry by bombing a city or group of cities.

Each adult in China is charged by the government to make 20 large bricks to be used in the building of fallout shelters. Children, as well as adults, carry these large bricks to the places where the shelters will be built.

Boys and girls are taught civil defense courses in the schools. They are also taught patriotism and self-sacrifice in protecting their country in the event of war.

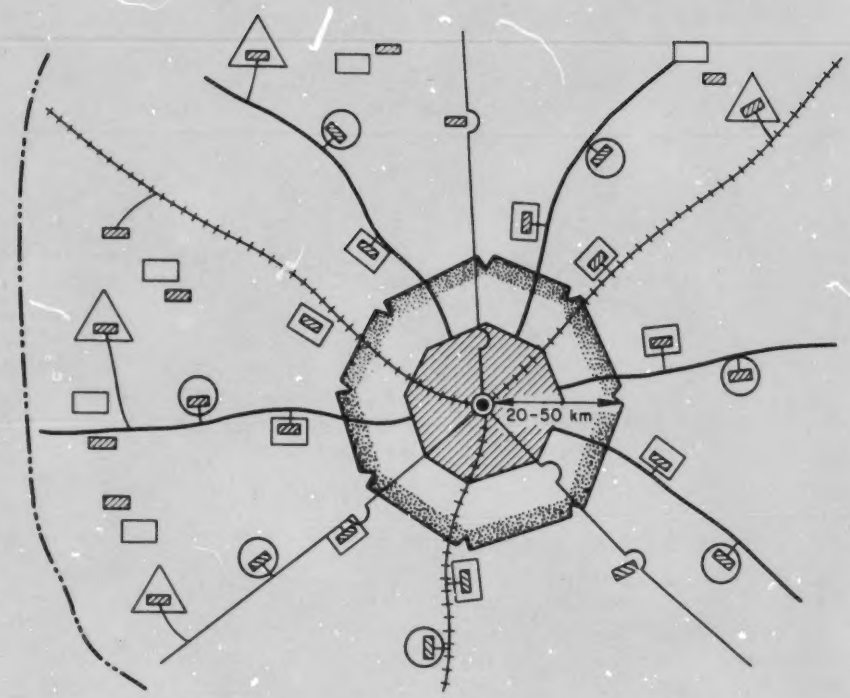
Union of Soviet Socialist Republics

The main aspect of Soviet civil defense is the evacuation and dispersal of the overwhelming majority of Russia's urban population to rural areas. Soviet research reveals that a nuclear attack on an unprotected large city may result in the loss of life of as much as 90 percent of the population. If the plan for removing most of the city dwellers to rural areas is effective, communist authorities feel that only five to eight percent of the city's inhabitants will be lost (visual 80).

Industrial workers in cities are to remain on the job and take refuge in special shelters at or near their place of work; but nonessential workers, school and preschool children, and retired people are to be transported to the country.

Plans for evacuation are detailed, including, for example, time schedules for departure to collecting points; the presence of a doctor or nurse on each evacuation train (or with every convoy of trucks); instructions as to what each family should bring (depending on climate and season); and special evacuation passes with a stub and a detachable slip for each person. Experience dates from World War II, when over ten million people and over 1,300 basic industries were successfully transferred from vulnerable areas to the interior. Since then, Soviet transport capability has moved rapidly forward. The system of railroads alone, the backbone of the USSR transport system, adds about 600 miles of new line and converts 1,600 miles of existing line to electric motor power per year. Motor transportation and maritime transportation have also made great strides, and the Moscow subway system, initiated in 1932, has grown in the past 35 years to 75 miles of track with more than 80 stations erected. Subways now exist in Leningrad, Kiev, Tbilsisi, and Baku. The daily number of subway passengers in Moscow is over four million. In addition to having the experience and capability for evacuation, the Soviets have developed a new civil defense transport service operated by a specialized staff.

A variety of types of shelters exist in the Soviet Union in the large cities. Shelters are heavily concentrated in certain areas and are fully equipped for prolonged occupancy. Workers who must remain in the city during and after attack and essential citizens will occupy these shelters. Subways in five cities will also be used for shelter. Larger buildings


20-50 km
GEOMETRIC CENTER OF THE CITY
BOUNDARY OF THE SAFE ZONE
LIMITS OPERATIONAL CONTROL
DISTRICTS FOR THE RELOCATION OF WORKERS OF PLANTS WHICH DO NOT STOP THEIR OPERATION
COMMUNITIES
DISTRICTS FOR THE RELOCATION OF WORKERS OF PLANTS WHICH HAVE TEMPORARILY SUSPENDED THEIR OPERATION
DISTRICTS FOR THE RELOCATION OF EVACUEES
DISTRICTS FOR THE RELOCATION OF EVACUATED PLANTS, ORGANIZATIONS, AND AGENCIES

Schematic Diagram of the Relocation of Dispersed Workers and Evacuated Persons and Plants.

Visual 80

and basements can be converted for shelter living.

On the farms and in small towns shelters have been made in basements, vegetable cellars, covered trenches, caves, and mines. Filter ventilation systems have been installed in permanent shelter locations. They also contain an adequate supply of bottled oxygen.

Fallout shelters in rural areas will be built when an actual threat of war occurs. The population has received plans for building emergency shelters in the short period of 20 to 30 man-hours of work. Although many shelters exist, Soviet authorities indicate that shelter construction is still going on.

At the other end of the evacuation plan for urban dwellers is the reception and protection of these evacuees in the country. In the rural areas stress is placed on the protection of livestock, water supply, food storage, and crops. The villagers are trained in techniques to protect livestock from radioactive fallout. Food and fodder storage will be protected against contamination.

Provisions are being made to evacuate essential machinery and workers to the farms. This will enable the Soviets to maintain production of necessary items in the event of nuclear war.

Farmers and their families have received guidance in training the city dwellers who are to be evacuated to the country to assist in food production. Consequently, if a major city is wiped out, the Soviet Union has made plans to provide for the necessary food and manufactured items to maintain life.

Educating the public concerning survival preparedness is the third aspect of Soviet civil defense. Civil defense training in the Soviet Union is compulsory and universal. Everyone is exposed to it -- school children in grades five through nine, both in classrooms and in summer camps; pre-draft-age men in military-sport camps and in educational institutions; industrial workers at their places of employment; and members of collective farms. There is multiple exposure in that civil defense is publicized at movies, on radio and television, and in magazines, newspapers, and factory publications. Civil defense courses are tailored to the needs and ability of the trainees. Farm children, for instance, are taught how to protect cattle, forage, food, and water supplies, as well as themselves. Factory employees learn rescue and reclamation operations and ways of reducing the vulnerability of their shops.

Beginning at the elementary level, protection against nuclear attack is taught. As a result of the new Law of Universal Military Obligation, the Soviet civil defense

effort has taken a marked thrust forward. Basic military training of youth has been introduced in the high schools and the trade schools, as well as in factories, institutions, and collective farms. The instruction includes knowledge of the properties of weapons of mass destruction and methods of protection against them. Compulsory civil defense education has been introduced into the fifth, sixth, and seventh grade classes of the secondary and eight-year schools of general education.

Civil defense instruction in Leningrad includes training in the use of small arms, motorcycles, and even parachutes. Other inducements for learning about civil defense include visits to national monuments and shrines and sessions with war heroes and with civilians who participated in the heroic defense of Moscow in World War II. Instructors are told outright to link bravery and heroism not only to the field of battle but also to defending the peaceful population behind the lines -- in the rear. It is an interesting sidelight to Soviet methods that while teachers are instructed to capitalize on their pupils' inclination for patriotism and to enlist their interest with such glamorous equipment as motorcycles, they are nonetheless cautioned: "It should not be forgotten that studies are work and not fun. Like any labor they require willful physical and mental strain."

In summer camps, where emphasis is on putting into practice what the children learned in the classroom, pennants, citations, and buttons are awarded for excellence in civil defense drills and exercises. The best detachments are singled out for gifts, and there is occasional television coverage of the exercises so that the children can see themselves on the television screen.

At industrial plants, contests are held among civil defense squadrons with awards for the winners. Distinguished performances in all areas of civil defense are cited in the press. Directors of large industrial establishments, shop heads, instructors, and ordinary factory workers have an equal chance to be named, for example, in the magazine, "Military Knowledge." Conversely, those who flagrantly shirk their civil defense responsibilities may also get to read about themselves. "The Unfortunate Comrade Blinov" was cited in the journal, "Military Knowledge," for his lackadaisical attitude toward his civil defense duties. He declined to make use of the special classroom set aside for a civil defense office; he failed to acquire sufficient training equipment and visual aids; and those he did get were not kept in order. Worst of all, the lessons conducted by Comrade Blinov "in content and in method are not worthy of criticism." Poor Comrade Blinov!

CHAPTER FOUR

CIVIL PREPAREDNESS IN TIME OF EMERGENCY

What Is Civil Preparedness?

Civil preparedness is many things to many people. It is planning and preparing to cope with the conditions of an anticipated emergency; it is individual and government response during an emergency; it is recovery operations following an emergency. Civil preparedness is all of these working together. Each concept plays a vital role in the primary objective of civil preparedness -- helping to save human lives.

Civil preparedness is not something new. Everything man has done to protect himself and his dependents from his enemies or from the ravages of nature could be classified as civil preparedness. It is not some special organization or group of people capable of waving a magic wand to save us from some possible disaster. It is made up of individuals, their social institutions, and their governments. Individual and group reactions may save lives, limit damages, and speed recovery during and after natural or man-made disasters.

Civil preparedness is a joint responsibility of federal, state, and local governments, and an informed public. The basic concept entails utilizing resources and facilities of all levels of government to meet assistance and recovery needs. Effective disaster preparedness cannot be provided after a crisis has occurred. Then it is too late. If the impact of disasters upon people is to be minimized, it is essential that each local community and each family be prepared to respond to such situations. It is local government that is the focal point of disaster preparedness. Individual, family, and community effort is necessary for human lives to be saved. Therefore, effective disaster response is directly related to individual, family, and community preparedness.

To the Individual

During a disaster you have two areas of responsibilities: to yourself and to the community. Your responsibility includes exercising disaster safety skills to avoid further injury. You should avoid any action that would pose a threat to your health and to others. Your second responsibility is basically one of cooperation. During times of disaster the need for cooperation is much greater. Local agencies, both public and private, are suddenly required to meet needs arising from the disaster stricken area. If everyone cooperated with these agencies, recovery would be more effective. Remember, civil preparedness is nothing more than people planning, cooperating, and working together at

all levels of government to enable us to survive and rebuild. How well this works is directly proportional to how well we plan, train, and act during and following emergencies or disasters.

The Federal Government and Disaster Preparedness

The federal role in this partnership is not new. It has its beginning in the United States as far back as 1916 when Congress created what was then called the "Council of National Defense." In 1918 that council was dissolved and it was not until 1940 that the idea was again given official sanction. On May 28, 1940, President Roosevelt created the National Defense Advisory Commission. A year later the Office of Civilian Defense was established. The concept of Civil Defense was given its greatest boost when President Harry Truman signed into law the Federal Civil Defense Program. On May 5, 1972, the name was changed again by Secretary of Defense, Melvin R. Laird, to the Defense Civil Preparedness Agency (DCPA).

The National Director of DCPA, in coordination with federal, state, and local governments, is responsible for the development and execution of the following:

Defense Civil Preparedness

1. A shelter program, including evacuation and movement to shelter;

2. A chemical, biological, and radiological warfare defense program;

3. Steps necessary to warn or alert federal military and civilian population of enemy attack upon the United States. Responsibility for developing, deploying, and operating military surveillance and warning systems remains with the appropriate military department;

4. Civil defense communications, including an appropriate warning network, communications between authorities, and communications procedures for the reporting on radiological monitoring and instructions to shelters;

5. Emergency assistance to state and local governments in a post-attack period;

6. Protection and emergency operational capability of state and local government agencies in keeping with plans for the continuity of government;

7. Programs for making financial contributions for civil defense purposes to the states;

8. Plans and the operation of systems to undertake a

nationwide post-attack assessment of the nature and extent of the damage resulting from enemy attack and the surviving resources, including systems to monitor and report specific hazards resulting from the detonation or use of special weapons. Such assessment should address civilian resources, whereas the military departments retain primary responsibility for assessing damage to military resources;

9. Necessary arrangements for the donation of federal surplus property in accordance with section 203(j)(4) of the Federal Property and Administrative Services Act of 1949, as amended (40 U.S. C. 484(j)(4)); and

10. The establishment and administration of a Civil Defense Advisory Committee to advise the Secretary of Defense.

Natural Disaster Preparedness

1. A program to utilize and make available the civil defense communications system for the purpose of disaster warnings.

2. Programs to provide planning assistance to state and local governments in their development of natural disaster preparedness plans and capabilities.

Organization of Defense Civil Preparedness Agency (DCPA)

DCPA, although located in the Department of Defense, is civilian in character and direction. Its headquarters is in the Pentagon. In addition, there are eight DCPA Regional offices located at Maynard, Massachusetts; Olney, Maryland; Thomasville, Georgia; Battle Creek, Michigan; Denton, Texas; Denver, Colorado; Santa Rosa, California; and Bothell, Washington. There is also a DCPA Staff College at Battle Creek, Michigan.

DCPA works with the 50 states, Puerto Rico, the Canal Zone, the Virgin Islands, Guam, American Samoa, and the District of Columbia. Through the states we reach the counties, parishes, and local governments to help them prepare to cope with effects of man-made or natural disasters.

The responsibility of the Federal Government is to provide overall guidance and direction as well as financial and other assistance to the states and their local communities. Their goal is to "help local communities develop and maintain plans and maximum capabilities in order to actually conduct coordinated life-saving operations in extraordinary emergencies." In carrying out this role, the Federal Government works with all the 50 states and some 10,000 local communities. Money and equipment have been made available to state, county, and city governments to improve their emergency response capabilities. This is part of the overall "On Site Assistance Program" (its real title: "Local Government on Site Operational Readiness Assistance Program") that is now being conducted throughout the United States. Under this

program federal, as well as state civil preparedness staff members, offer an "upgrading" service to local governments (counties, cities, and towns). Representatives of federal and state government will enter a local area under a joint federal-state-local agreement and undertake to survey the existing civil preparedness needs, resources, and capabilities of the area; and help them formulate an action plan to improve the communities' emergency operations capability. DCPA and the state agency then furnish all possible assistance to local officials in carrying out their action plan. This plan includes not only DCPA and state assistance, but also aid from other federal departments and agencies which DCPA has arranged to call upon when their programs can contribute to the emergency readiness of communities. A few of the key government agencies are National Weather Service, Nuclear Regulatory Commission, Department of Agriculture, Federal Disaster Assistance Administration, and other public and private agencies.

Community Shelter Planning (CSP), begun by DCPA in 1965, encourages and helps participating communities to plan for the most advantageous use of public and private fallout shelter spaces in a time of nuclear attack. It calls for each local government to designate the particular shelters to be used by specific groups of residents, and to make these assignments of allocations known to all residents, either before or when a nuclear attack is probable. At present, community shelter plans are completed or are underway in more than 2,700 U. S. counties, which contain more than 80 percent of the nation's population.

Crisis Relocation Planning -- The Final Step

John E. Davis, Director of the Defense Civil Preparedness Agency, regards crisis relocation planning as probably the final element in the evolution of DCPA's expanded program.

Crisis relocation planning can be defined as "advance arrangements by local governments to temporarily relocate their residents when a nuclear attack or peacetime disaster threatens."

The role of DCPA (and the state civil preparedness agencies) is to encourage and help local authorities plan the orderly relocation of residents, to protect them from the effects of recognized, slowly developing threats.

In peacetime, such threats are mainly hurricanes and floods. In a period of developing international tension, relocating residents from certain areas (mostly cities) could greatly increase their chances of avoiding the blast, initial nuclear radiation, heat, and fire effects of a nuclear attack.

Such peacetime or wartime relocations are considered feasible only for catastrophes that can be anticipated. Planned relocation is not practical as a protective measure against sudden and unpredictable disasters such as tornadoes, earthquakes, major peacetime accidents (plant explosions, serious transportation mishaps,

etc.), or enemy attack that occurs without warning. In regard to the latter, the Department of Defense considers such a possibility extremely unlikely. If an attack occurs, it most certainly would be preceded by a buildup of extreme international tension.

Development of DCPA's new Crisis Relocation Program is now well under way. During 1973, two prototype studies were made, in Richmond, Virginia, and San Antonio, Texas. These demonstrated the feasibility and value of relocating residents when disaster threatens their community.

To test further the relocation concept, identify problems involved, and devise the best procedures for authorities to use in relocating and taking care of residents, DCPA is conducting "pilot projects" on relocation planning in eight metropolitan areas across the country (one in each DCPA Region).

Using experience gained in the prototype studies and pilot projects, DCPA plans to work each year with the public officials of about 50 U. S. metropolitan areas (and their state officials), to help the civil preparedness directors in those areas develop crisis relocation plans for their residents.

Civil Preparedness Training

The training of personnel is also one of the main functions of the federal role in civil preparedness. The Defense Civil Preparedness Agency (formerly the Office of Civil Defense) operates a Staff College at Battle Creek, Michigan. Through this college the training of federal, state, and local personnel in special civil preparedness courses takes place. Training is offered in such areas as National Programs for Civil Preparedness, Civil Preparedness Planning and Emergency Operations, Radiological Defense Officer and Industry/Business Emergency Planning, and many others. Civil preparedness courses are also being offered through extension services in many of the major universities.

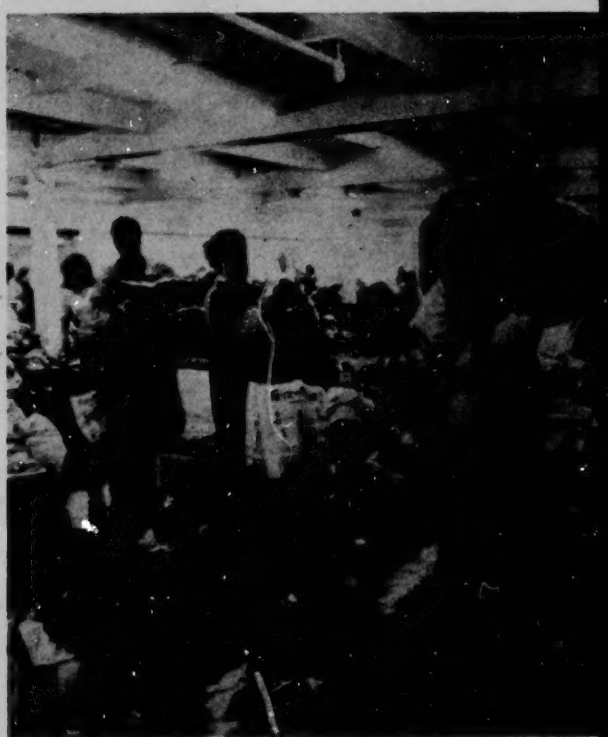
What Aid Is Available?

Following a major disaster a number of immediate needs are obvious. People must have water, food, medical supplies, shelter, and clothing (visual 80). In most disasters such initial aid will have to come from outside the stricken area. Cities and counties adjacent to the stricken area usually assist by providing rescue personnel and equipment, medical personnel and supplies, law enforcement assistance, and many other types of aid (visual 81).

A great deal of immediate assistance is also provided in cooperation with local and state government by such organizations as the American Red Cross, the Salvation Army, the Mennonite Disaster Service, and others (visual 82). The efforts of all these groups are directed toward the relief of immediate suffering brought on by the disaster. Should this disaster be of such magnitude that the resources of local government and local relief agencies are unable to meet the critical needs of the

Visual 80

Visual 81



Visual 82

people, then the state and Federal Government will step in and offer assistance. Federal agencies can supplement local and state efforts to provide emergency shelter, medicine, food, and other supplies.

Restoration of public utilities will be of vital concern to all. The service units of these utilities will begin work immediately to achieve this (visual 83).

Emergency public transportation can also be provided in order to enable the community to resume its normal pattern of life as soon as possible. It may include transportation to relief centers, stores, post offices, schools, employment centers, supply centers, and any other such places. Again, it is the local and state governments' major responsibility to supply these services, but if these resources are inadequate, federal assistance can be obtained.

One of the biggest problems facing the victims of disaster is how to start over again. Assistance is available to families for emergency housing, food, clothing, and personal needs.

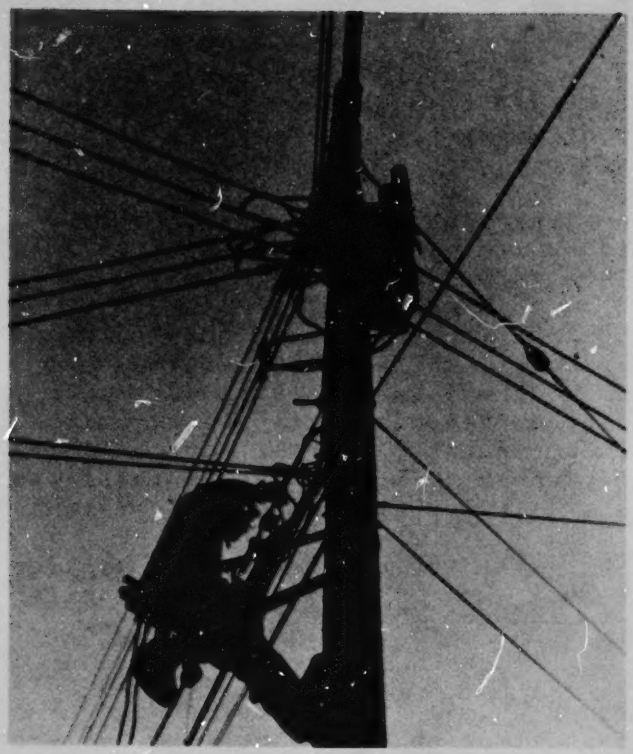
Low interest loans for rebuilding purposes are available to individuals through the Small Business Administration and the Farmers Home Administration. The American Red Cross, as a private relief organization, also may offer assistance for the purpose of reconstruction. The Veterans Administration also has the authority to change the terms of loans they have made to people who have suffered losses as a result of the disaster.

Temporary housing for victims who have seen their homes damaged or destroyed is also available through the Federal Government. The government can provide housing through the use of government facilities, the leasing of existing structures, the use of mobile homes, etc. This housing is provided without charge until repairs can be satisfactorily completed on the victim's original dwelling. Again, as in the case of almost all federal relief, this program is managed by the local and state government agencies.

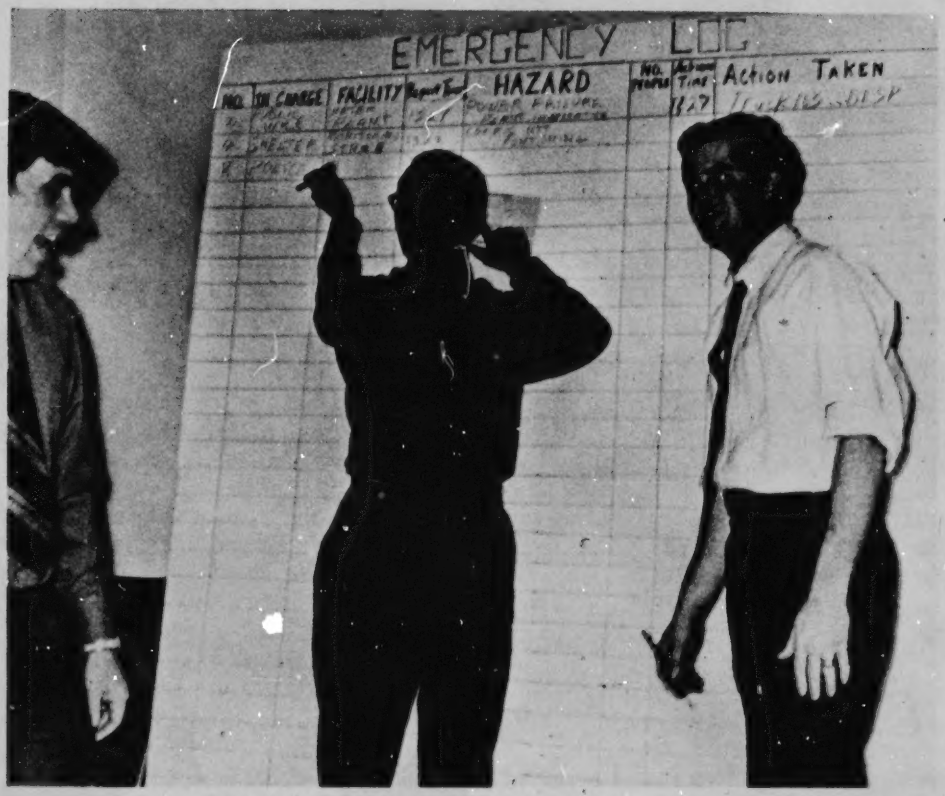
For those people who find themselves out of a job because of the effects of a disaster, relief is available through "disaster unemployment assistance." This assistance is in the form of temporary income and reemployment services.

Additional disaster assistance can be offered by way of legal services for those unable to provide their own. Mortgage and rental payments can also be provided for those people who have suffered hardships as a result of the disaster and are unable to make these payments.

As we can see, there are a great number of disaster relief programs that are available to assist the individual and the community in time of disaster. With so many available sources of assistance, it would be a disaster in itself if the individual



Visual 83



Visual 84

had to go to a different place for each service. In order to see that such a situation does not arise, the Federal Government, in cooperation with the state, will establish "one-stop relief centers," called Disaster Assistance Centers. These centers will be established in the disaster area and will house all the federal, state, and local agencies that deal directly with the needs of the individual victim. This one location will make it more convenient for the individual to receive assistance and to bring about hope for his immediate recovery.

The State Role in Disaster Preparedness

State civil preparedness agencies have a number of critical functions to perform. The state agency coordinates relevant federal and state programs. The state serves as the coordinating agency for financial assistance to counties and cities. Civil preparedness planning for state and local governments is coordinated by the state agency. Assistance in the form of federal and state aid is coordinated by the state. The state supplements the efforts of local public and private agencies following a disaster or emergency. The role of the state in civil preparedness might best be demonstrated by an example of state responses to an emergency.

When a hurricane approaches the coast, certain preparations are being made by state government. The state highway agency may begin to alert personnel and prepare to concentrate equipment and manpower where immediate aid can be given. The public safety agency begins to review plans for evacuation of the threatened area. Personnel are alerted and equipment is checked for use in the disaster area. The public welfare agency reviews plans for sheltering and feeding evacuees. The public health agency prepares for inspection of polluted water systems, stocks essential medical items, and reviews immunization programs for possible implementation. Agencies with a rescue capability are alerted for possible service. National Guard forces are alerted for possible deployment, since it is a state force. Other state agencies with disaster assistance responsibilities will plan for carrying out their role if the hurricane strikes the coast. If the hurricane does strike the coast, public and private agencies put plans into effect to alleviate suffering, save lives, and minimize damage to property. The state has a vital role in implementing disaster assistance programs. State governments vary, but the functions to be performed are generally the same (rescue, public safety, public welfare, etc.).

Local Government

What Is Local Civil Preparedness? The local structure is basically similar to that of both the state and Federal Governments. Civil preparedness directors and coordinators at the local level function similarly to their counterparts at the other levels.

They serve their chief executive (mayor, commissioner, and local agencies) organizing and offering guidance in the planning of the local response to a disaster. They are also responsible for creating interest, motivation, and community involvement in planning to cope with major emergencies.

The local resources of civil preparedness are all those organizations and individuals who could offer some specific assistance. The police, fire department, and local ambulance and rescue squads would carry out their normal services during a disaster, but do so under emergency directions of the local governmental plan. The doctors and hospitals of the community form a link in the chain of civil preparedness. Churches and voluntary organizations work under local governmental and civil preparedness coordination to offer assistance -- food, clothing, housing, etc. -- that might be needed. Local radio and television stations perform such emergency services as warning and keeping the public informed. County and city officials continue to function, but with emphasis placed upon the emergency services under their control.

When a disaster strikes, the local civil preparedness coordinator and city and county governing officials move into a "command post" known as the Emergency Operations Center (EOC). The "EOC" is a centralized point for emergency communications and coordination. From here the chief executive (president, governor, mayor, etc.) and local department heads can exercise the necessary direction of emergency operations and actions needed to protect and assist the citizens (visual 84). All of the regular governmental services of the community are centered here, but on an emergency basis (visual 85). Each new disaster situation is reported to the EOC. The necessary response is then taken by the required agency. For example, if a fire is reported during a disaster, the fire chief directs fire-fighting equipment to the location. The chief of police issues orders for traffic to be re-routed so as to avoid the area concerned. If needed, medical supplies and personnel might be sent.

The local community is the scene of the disaster. It is the focal point for federal and state assistance. Communities throughout the nation are preparing to cope with disasters and emergencies. Emergency operations plans are being written and revised. Modern communications systems for warning and control are being installed. A greater degree of readiness exists now than in the past. Cooperation between city and county governments will further improve the emergency response capability.

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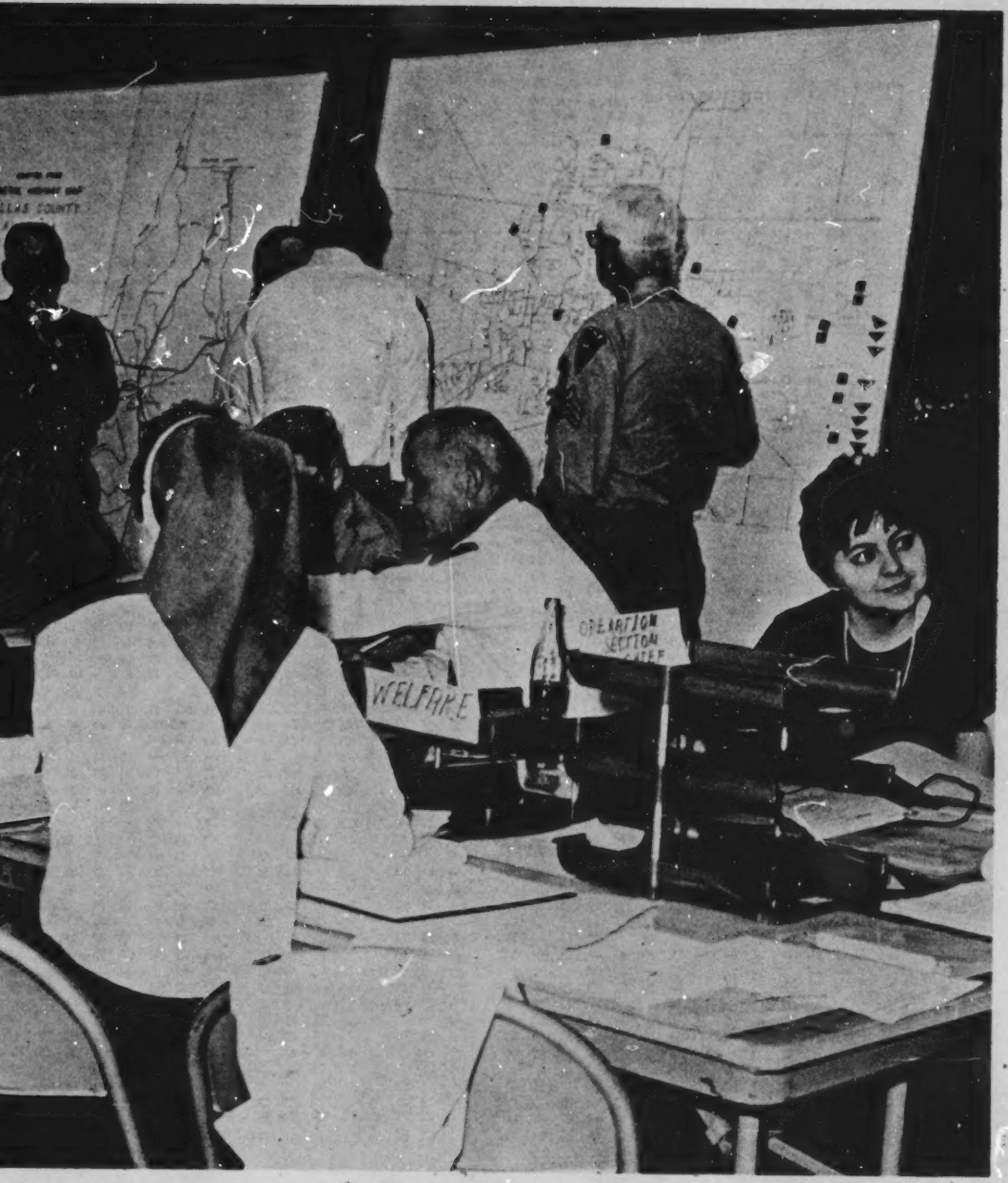


Visual 85

CHAPTER FIVE

POPULATION - POLLUTION - PETROLEUM

Today there is much concern over the possible harm man is doing to his environment. A noted ecologist and author of several books refuses to take out life insurance because he is convinced that mankind is doomed to annihilation in the next 50 years as a result of pollution and/or nuclear war.

The growing concern over our environment is often pictured from one side only -- how man and his activities are the sole cause of the deterioration of our environment. We must, however, view the other side of the ecology issue and be aware of the fact that if no human had ever lived on earth, there would be pollution from natural causes. Man often forgets that nature, through natural processes, frequently pollutes itself.

In 1956 a large volcano in Indonesia erupted and spewed millions of tons of matter into the air. It took eight to ten years for most of the material to be eliminated from the atmosphere.

Each summer in Chesapeake Bay, menhaden, a type of fish, die by the millions. It has happened every summer for as long as man can recall, and it will probably continue to happen. Why? The cause is not known, but it is a natural process.

When a lightning bolt strikes and is followed by a shattering roll of thunder, or if high winds blow, is not this noise pollution? Are the tons of pine pollen released into the atmosphere each spring polluting the air? Does a forest fire contribute to air pollution? Where once deep bays existed, now in some instances they have become so filled as a result of sedimentation that they are quite shallow. Is the natural process of sedimentation to be considered as water or land pollution?

To the hay fever sufferer the pine pollen is an irritating and potentially harmful source of pollution, but it brings economic success to the tree farmer and forester. To the oyster gatherer the natural sedimentation process may be very destructive. The sediment covers and kills the oysters, but to the farmer the deposition of new soils along the shore from the same sedimentation process could bring continuous high yields of vegetables and other crops without any expenditures for fertilizer. Pollution to one person, therefore, may not be pollution to another.

For our purposes we can define pollution as the deposition of material into the environment which poses a direct threat to man or man's life support system (ecosystem). As a result the disposal of waste products into the air, water, or onto the land must be measured to determine if a threat exists. Methylmercury, for example, is known to have been present in prehistoric animals, but

has the industrial use and dumping of this chemical into our water supply endangered man's life support system? Does the smoke from industrialized cities threaten man or his ecosystem?

While it is easy to study some of the problems of pollution in our world, nation, state, and community, we must also realize that many people are working to control pollution. We must also seek to find positive solutions to the common problems associated with air, water, land, and noise pollution, but first we need to find out why the pollution of our environment is a growing problem.

Although nature herself is a polluter, natural pollution is usually taken care of by natural means. When man adds his man-made pollutants, however, the burden becomes too great for nature to control. Man is a part of the ecosystem. "Ecology" means the forms of life on earth and how they survive, while "system" is their way of life. Each specie of life in the ecosystem has its own vital part in the natural world around it, and this natural world may be thought of as a community within itself. Think of a pond as one of these communities with its simple plant life and various classes of animal life. The sun provides energy for the plants (plankton and/or algae) by the process of photosynthesis. Simple animals can live by consuming the plants. These animals, in turn, provide energy for larger animals which are consumed by man. Thus man, in most cases, is the ultimate or last consumer. Left undisturbed the ecosystem, interacting within itself and between each part, contributes to the balance of life on the earth. When man introduces substances that may be poisonous, then a multiplier effect takes place in the ecosystem. The multiplier effect in the ecosystem would operate in the following way. Suppose a lake or pond near where you live is sprayed with a particular chemical in an attempt to control mosquitoes. The chemical sprayed on the water is absorbed first by plankton or some form of algae. The plankton or algae will contain 0.01 parts per million (ppm) of this chemical. Next the plankton is eaten by a mud snail. Because the snail requires more than one plankton to survive, many are eaten and the snail has a chemical concentration of .41 ppm. A fish in the pond eats five or ten snails and has a chemical concentration of six ppm. A duck eats several fish and the chemical concentration is multiplied up to 100 ppm in the duck. Eventually two or three ducks are shot and eaten by a hunter. Thus, the concentration in the man is extremely high -- much higher than is thought to be safe. What was once a relatively harmless chemical sprayed over a large area has now become a highly concentrated poisonous substance which can injure or kill man.

The rate of population growth in the world is an important factor in the present environmental imbalance which has occurred. The number of people inhabiting the earth has increased drastically during the past few decades. After 600,000 years of growth, the population of the earth reached one billion by 1830. In a period of only 100 years the world's population doubled to two

billion in 1930. Today, the number of people has again doubled to four billion. At this rate the world's population will reach the eight billion mark during the next twenty-five years.

Population growth occurs when there are more births than deaths over any period of time. The rate of world population growth has increased from 85,000 per day in 1930 to 190,000 per day in 1972. The annual growth rate has now reached 72 million. In the time it takes you to read this paragraph, 193 people have been added to the world's population. As the population continues to grow, environmental experts express concern for the problems which will be created by this population explosion. To understand the need for concern about rapid population growth we will examine the causes and effects of this overpopulation.

The improvement in medicine and surgical practices has eliminated many of the dreaded diseases of the past. Today many people who would have died from smallpox, typhoid fever, and bubonic plague are free from the fear of contracting and dying from these and other preventable diseases. As medicine has conquered the killer diseases of the past, the population has increased.

The perfection of agricultural methods in the developed nations of North America and Western Europe has freed many people from the ravages of starvation and famine; but in the underdeveloped countries of Africa, Asia, and Latin America, the population is growing so rapidly that agriculture has not been able to provide the necessary food for survival. At least 10,000 people die each day from malnutrition or starvation. As more and more people are born in these areas, the strain upon food production will increase. Some food experts tell us that starting in 1980 famine may become widespread as a result of the inability of farms in underdeveloped countries to produce enough food to feed the increased population.

You may ask why population growth is a problem and how it will affect each person on the face of the earth. With a large growth in population there is a demand for more food. Some agricultural experts believe that the United States with its many surplus foods produced every year can only support about twice our present population. The United States may reach this population figure around the year 2010. By the year 2050 the United States may have a population of one billion.

Since the industrial revolution our cities have grown in size as large numbers of people have moved from rural to urban areas to work in factories. Cities have become transportation and communication centers to produce and distribute the products of industry. Today in the United States, 80 percent of the people live on only two percent of the land surface. This situation is also true in most other countries of the earth. Pollution is one of the problems which has been magnified by the growth of urban

industrialized areas. With the concentration of more people in smaller areas there has developed an awareness of the large quantities of resources needed to support these people. During the presidency of Theodore Roosevelt much attention was directed to the dangers of the reckless use of our natural resources and the pollution of the environment. One of the first laws enacted to protect our environment was the 1899 Rivers and Harbors Act which prohibited the discharge of any solid pollutant into any river or stream. The need for a more comprehensive pollution control program, however, was de-emphasized during World War I, the depression years, and World War II.

It was not until the late 1950's that a national awareness of the seriousness of our pollution problems developed. For the first time many Americans saw "No Swimming" signs appearing in resort areas. An increase in air pollution resulted in smog conditions and endangered health. Commercial fishing sites, such as San Francisco Bay, began to disappear, affecting the economic stability of many areas. Although much of the pollution was first noticed in heavily populated areas, the effects of pollution began to affect distant rural areas as well. Air pollution from many industrial plants created smoggy, odorous conditions in neighboring rural areas.

The concentration of large numbers of people in a small compact area has created a solid waste problem as well. Millions of pounds of trash and litter have caused many collection and disposal problems. Much of this solid waste is now being burned or allowed to decay in dumps. However, the burning of this material contributes to air pollution, and allowing it to decay poses a real threat of contaminating subsurface water sources from which many Americans obtain their drinking water. Only a small percentage of the solid waste at present is being recycled for future use.

During the fall of 1973 and the winter of 1974 the United States suffered an acute energy crisis. Blackouts and brownouts occurred in many major cities, and the gasoline shortage reached the point of major crisis.

Some states initiated rationing programs and virtually mandated the compliance to established conservation measures. The price of gasoline that was available soared to price levels heretofore unknown in the United States, and the predicted high for the summer of 1974 was 75 cents per gallon. By the middle of May, 1974, the immediate critical shortage seemed to have eased but the prices remained high. Many states which had enforced rationing dissolved their rationing programs and substituted voluntary conservation guidelines. A national speed limit of 55 MPH was recommended by the President, and practically every state had implemented this request into law by April, 1974.

The major sources of domestic energy -- petroleum, natural gas, coal, hydropower, and nuclear power -- were examined very carefully during these months; and Congress rendered support to many research and developmental projects designed to improve domestic production.

International problems, such as the tension in the Middle East, had a severe impact upon the availability of foreign sources of energy.

The problems relating to population, pollution, and petroleum are not simple; but the basic fact is that more people demand more goods and services. We do have alternatives in dealing with the tremendous population increase and the resulting problems that are occurring in the world. India has begun a population control program to slow down their rapidly growing population. The population increases and resulting problems can be relieved by devoting much energy, time, and money to developing and applying technological knowledge to the specific causes and effects of many of these problems.

Industry may have to reduce its production to avoid pollution; therefore, man may have to settle for fewer material possessions. He may have to accept the rationing of foods as the growing population places a strain on our available food supply. He will have to become accustomed to highly congested working and living areas. This will, in turn, increase the level of noise pollution. Energy will continue to be a problem for years to come.

Man has now reached the point where he must decide what course he must pursue. At the present time Americans are confused as to which problems facing our country should have top priority. World peace, poverty, and pollution are only a few of the problems which must be considered. History has shown us which priorities Americans have chosen in the past, but it is now necessary for us to review our national commitments and decide what our priorities shall be in the future.

The following chapters on air pollution, water pollution, noise pollution, and the energy crisis will acquaint the reader with the critical nature of some of the problems and what must be understood before adequate solutions can be proposed.

CHAPTER SIX

AIR POLLUTION

What is air? What is clean air? What is polluted air? Most people use the terms "clean air" and "polluted air" without knowing the real meaning of either.

There is no such thing as completely "clean air." Air is a mixture of many different gases and solid substances. In addition to the three most common gases -- nitrogen, oxygen, and carbon dioxide --large quantities of water vapor, dust, and many other types of gases and particles are found in the atmosphere. When man first appeared on the earth, forest fires, erupting volcanoes, tornadoes, and dust storms contributed to natural air pollution. However, through natural cleansing processes, wind and rain, natural pollution sources did not pose a threat to life on the earth.

With the rapidly expanding population and the increasing demands of this expanding population for consumer goods, more industries had to be built in order to produce the demanded goods. For example the number of automobiles in the United States has doubled in the last ten years. The over-riding theme of the rapid industrial and urban expansion was to get the goods to the consumer. Little or no consideration was given to air pollution control measures. As a result, today we are faced with a great quantity and variety of wastes being spewed into the atmosphere.

How does an individual know whether or not the air in his community, city, or state is polluted? According to standards established by the Environmental Protection Agency in Washington, D. C., the maximum allowable level of particles in the atmosphere should not exceed 75 micrograms per cubic meter of air. Anything above this level could be called polluted air and may constitute a threat to the health of mankind. There may also be economic losses from such things as damaged crops, corrosion of metals, and curtailment of outdoor recreational activities.

Of the three basic necessities of life -- air, water, and food -- air is the immediate necessity. Man can live about five weeks without food, seven days without water, but only five minutes without air.

Status of Air Pollution

The problems of air pollution are not new. In 1272 King Edward I attempted to clear the skies of London by issuing a ban on the use of a smoke-producing type of coal. Punishment for selling and burning the outlawed coal, as ordered by the Parliament, was torturing and hanging. Later the use of such coal was

severely taxed by King Richard III. In 1952 London had a unique experience, the "Black Fog," that lasted for two weeks. What started out as a white smog had turned completely black by the third day. The smog was so thick during the two-week period that conductors were forced to hold lanterns in front of the buses to guide the drivers, the dog races were cancelled because the dogs were unable to see the rabbit they were to chase, and theatres were closed because fog seepage prevented viewers from seeing the screen. This episode lasted for two weeks.

Presently over 280 million tons of pollutants pour into the air of the United States annually. These pollutants are generally concentrated in the air of urban industrialized areas such as New York, Los Angeles, and Birmingham.

Air pollution is no longer a local or national problem; it has become a world-wide problem as well. London, Moscow, and Tokyo all suffer from air pollution.

In 1970 former Secretary General of the United Nations, U Thant, pointed out that air pollution was not confined to one country but affected most of the nations of the world. There were three major ideas contained in his address: (1) Air pollution was said to have reached crisis proportions in many areas of the world; (2) The universal scope of air pollution, therefore, was established; (3) The point was made that for the first time in history air pollution may threaten man's very survival.

Tokyo, Japan, has been referred by some to be the world's most polluted city. To combat this problem the city government found it necessary to install on street corners coin-operated machines that dispense an oxygen mixture by means of a mask similar to those found in hospitals. At ten of the city's most trafficked intersections the traffic policemen regularly take an "oxygen break" every half hour. Los Angeles, Paris, and London may have to follow Tokyo's lead in supplying breathable air for their citizens.

Although air pollution is concentrated in large cities, small towns and rural areas are not free from the effects of polluted air. Unpleasant odors and smoke from factories and plants may ruin vacation and camping trips in the country (visual 86). Many once breathtaking scenes are now blocked out by pollution (visual 87).

Types of Pollution

Pollutants can be classified in two general categories: particulate matter and gases.

Particulate Matter

Particulate matter is any solid or liquid matter such as dust,

Visual 86

Visual 87

Visual 88

115

smoke, fumes, mists, or sprays in the atmosphere. The particles are measured in micrograms. A period at the end of this sentence would weigh 1,000 micrograms. Many large newspapers publish daily particulate counts for their cities. As published in the newspapers the particulate count means the weight of particles in one cubic meter of air. The Environmental Protection Agency states that no city should have a particulate count exceeding 260 for any one given day.

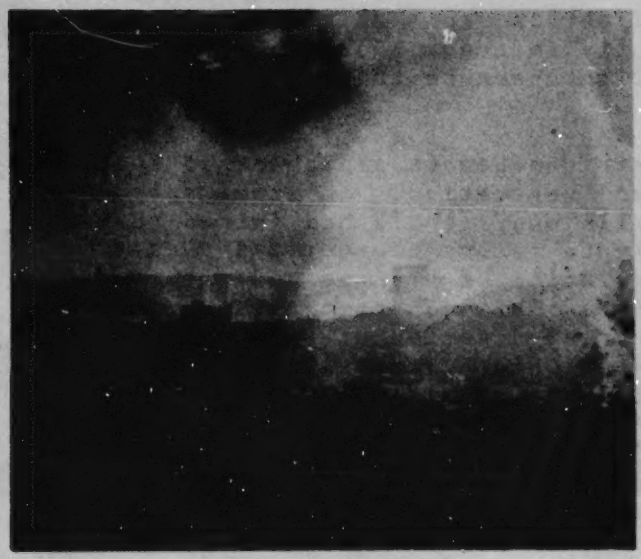
The particulate count can be affected by certain weather conditions. For example, temperature inversion can cause a rapid building of pollutants in a heavily industrialized area. An air inversion takes place when a mass of warm air moves over cooler air below (visual 88). The cooler bottom layer is trapped by the warmer air and cannot rise. When this takes place, the pollutants from a city are trapped and cannot be carried away by the winds as is normally the case. If the particulate count should reach 375 during a 24-hour period, local governments may take emergency procedures to protect the general health and well-being of its citizens. An air inversion in Birmingham during November, 1971, prompted a United States district judge to evoke the emergency provisions of the Federal Clean Air Act of 1970 by ordering 23 industries in the area to close down when the particulate count reached 675 (visuals 89 and 90). The industries were closed until the inversion ended.

Several disasters have occurred because of air inversions. One took place in Belgium's Meuse Valley in 1930. Sixty deaths were recorded and 6,000 became ill. London had an inversion in 1952 that lasted for five days. During this period 4,000 people more than the average death rate died. Donora, Pennsylvania, also experienced a temperature inversion in 1948. Twenty people died and 6,000 suffered ill effects.

It is believed by many experts that air pollution may significantly affect the amount of rainfall. One essential ingredient for rain is particles suspended in the air around which water vapor will collect. More than enough particulate matter is supplied by nature for rainfall, but large additions of man-made particulates can increase the amount of rain in highly polluted areas.

Documented research for the last 60 years in LaPorte, Indiana, a city located 30 miles downwind from the heavily industrialized area of Chicago, has shown increased rainfall when the Chicago steel industry is in full production. Similar research in Tulsa, Oklahoma, has resulted in the same conclusion. Another interesting fact uncovered by the research indicates a slight drop in rainfall on weekends in industrialized areas, seemingly due to the decrease in industrial activity on weekends.

Particulates also play a significant role in the creation of haze or smog. An excessive amount of particulate matter in the air will reduce the amount of sunlight reaching a heavily polluted city (visual 91). On many days of the year residents of large



Visual 89

Visual 90

Visual 91
117

cities are subjected to hazy weather conditions, not caused by nature but resulting from an excessive amount of particles or gases in the air. Leningrad has 70 percent less sunlight in winter months because of the increased smoke from coal fires. London has 20 percent more daylight in areas of the city where the air pollution rate is slightly reduced. Rural areas receive from 15 to 20 percent more sunlight because the air contains less pollution.

Particulate matter in the air can become a problem of dust accumulation on cars, houses, and vegetation. In areas near cement, fertilizer, or steel mills many people are forced to wash their cars and houses constantly to remove the corrosive dust. Some people have found that a solution of vinegar and water will remove all of the industrial dust. This constant cleaning can become costly and be a nuisance over a period of time. In 1970 a study was conducted in the upper Ohio River Valley where several cities are plagued with high air pollution levels. An analysis was made of the cost of maintenance of walls, windows, rugs, carpets, drapes, upholstery, and laundry. Data concerning air pollution levels and related factors were considered. It was determined that living in this heavily polluted area increased the cost of living approximately $200 per person each year.

Gaseous Pollutants

Sulfur oxides are formed as a result of the burning of fuels or trash and appear in certain manufacturing processes. When combined with oxygen and moisture in the atmosphere, they can become the corrosive agent, sulfuric acid. In heavily industrialized areas it is estimated that houses must be painted twice as often as houses in less polluted areas. Sulfur oxides cause marble, limestone, and mortar to flake and erode into a powdery substance which is easily washed away in the rain and wind. The Lincoln Memorial is a good example of the way air pollution affects building materials. The names of the states carried on the stone border of the memorial have virtually disappeared because of the level of sulfur oxide in the air. The hieroglyphics of "Cleopatra's Needle," the Egyptian obelisk given to the city of New York, have been eaten away by the air pollution of the city.

Three common types of fabrics -- cotton, wool, and silk -- are weakened and deteriorate when they are repeatedly subjected to sulfuric acid, ozone, and other air pollutants. Reports from New York City and Los Angeles indicate that nylon materials, such as stockings, suffer some deterioration within a matter of minutes when subjected to these pollutants (visuals 92 and 93).

A look in the library or your school locker reveals another problem caused by sulfur oxides in the air. Paper absorbs sulfur dioxide, becomes brittle, and loses much of its strength over a period of months. Leather bindings are actually eaten away by this corrosive pollutant.

Plants, such as corn, turnip greens, lettuce, and tobacco,

are damaged or destroyed by sulfur dioxide. Plant tissue is injured and leaves are discolored. The growth of these plants is retarded and crops produce smaller yields. Agricultural losses within the United States are currently estimated at $325 million annually.

Carbon Monoxide

Carbon monoxide, an emmission of the gasoline engine, reduces the oxygen content of the blood. Under certain atmospheric conditions in areas of heavy traffic, the carbon monoxide count in the air reaches dangerously high levels. Persons with some type of heart or circulatory disorder are the first to be affected under these conditions. Even when the carbon monoxide count is not so high, enough of the poison is found in the air of large cities with an abundance of traffic to have a harmful effect on the heart and to increase the death rate (visual 94).

A taxi driver in New York City changed from working in the daytime to driving at night. His reason was that the fumes from the heavy daytime traffic gave him a severe headache. Others suffer from eye irritation, blurred vision, dizziness, and slowed physical responses. These are reactions from carbon monoxide in the air.

Oxide of Nitrogen

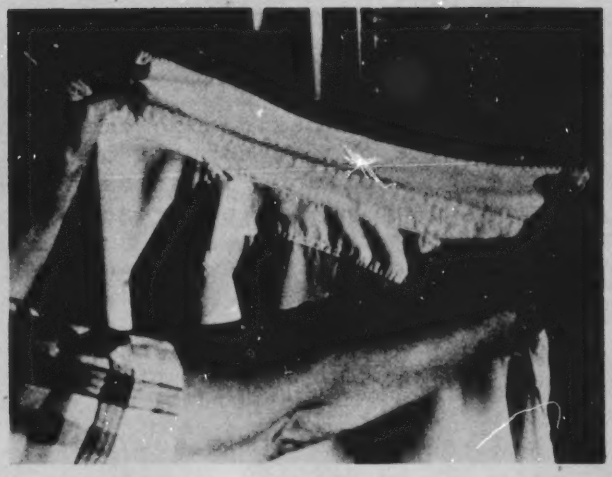
In the burning of fuels, nitrogen unites with oxygen to form a number of deadly nitrogen oxide gases. An example of the lethal effects of these gases occurred in a Cleveland, Ohio, hospital several years ago when an X ray file room caught fire. As the X ray film burned nitrogen dioxide gas was formed which killed several people before the alarm was sounded. The nitrogen oxides may cause injury to vegetation, clothing, and metals in much the same way that sulfur oxides do. A combination of these pollutants corrodes aluminum five times as fast as it would corrode in air which does not contain these oxides. Iron will corrode six times and steel thirty times as rapidly causing structural damage to bridges and buildings (visual 95). The oxides of nitrogen are also blamed for causing many lung and respiratory diseases.

Hydrocarbons

Hydrocarbons are also formed by the burning of fuels. In cities with congested traffic problems, such as Los Angeles, hydrocarbons are a real problem. Over 100 miles from Los Angeles pine trees were found withering and dying for no apparent reason. An investigation into the cause revealed that the trees apparently were dying from the smog overflowing from Los Angeles.

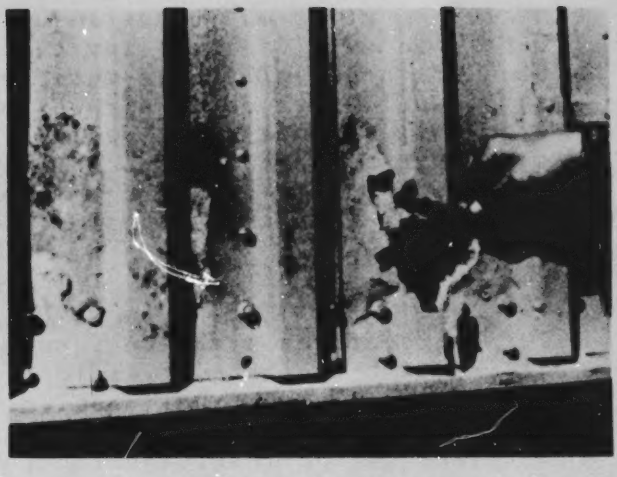
Hydrocarbons also damage the respiratory tract of man,

Visual 92



Visual 93

Visual 94



Visual 95

lessening his resistance to a number of respiratory ailments.

Photochemical Oxidants (Ozone)

This pollutant is produced as a result of the combination of nitrogen oxides and hydrocarbons. This gas irritates the eye, nose, and throat areas of the human body much the same as a cold would do. In cities such as Tokyo and Los Angeles many people cover their faces with handkerchiefs to protect themselves.

Ozone also damages plants (primarily the leaves) and materials such as cloth and rubber goods. Cleaning and laundry bills are about three times greater in areas of high ozone concentration than in areas with a low ozone pollution rate. Increased costs for cleaning and replacement also apply to rugs, carpets, draperies, and upholstery.

Automobiles and trucks are hard hit by photochemical smog. Tires frequently have to be replaced, not because the tread is worn away, but because the smog has caused cracks along the sides of the tire. Windshield wipers wear out more quickly as well.

Other Pollutants

There are many other pollutants which can do severe harm to man and his environment, even though they are not usually present in large quantities. It is known that ponderosa pines for over 50 square miles were killed near Spokane, Washington, when an aluminum ore production plant spewed flourides into the atmosphere. Fluorides also present a danger to livestock. Fluorides emitted from a steel, aluminum, or fertilizer plant eventually fall to the ground. Over a period of time grass on pasture land will build up a considerable amount of fluoride. While the plants experience no ill effects, animals that eat them may become sick. Spots and streaks appear on the cattle's teeth. They begin to lose weight and give less milk. Growth and development of younger animals are retarded and bones become deformed and brittle. Finally the cattle become crippled and must be slaughtered.

Physical damage due to air pollution may take place in numerous areas of the body. Most of the harmful physical conditions are created through a process involving a long period of time. Difficulties are not usually detected until after severe injury has taken place. Some of the physical problems and diseases associated with or complicated by air pollution will be discussed in this section.

Caution should be taken when a disease and air pollution are linked together in a cause and effect relationship. Authorities are unable to prove that air pollution is the sole cause of any disease; on the other hand, air pollution does appear to

be connected in some measurable degree with a vast array of diseases. Scientists employ several methods of research in studying the relationship between contamination of the air and certain diseases. A combination of research techniques is usually utilized before definite conclusions are drawn.

One method involves taking epidemiological surveys. Epidemiology is the study of the effects a disease has on a community rather than on one individual. How the disease is contracted and spread to others is studied. The relationship of age, race, sex, climate, and other factors relative to the illness is evaluated. The long-range results of living in a heavily polluted area have been measured by epidemiological surveys. Findings of other research methods are necessary to validate the evidence resulting from this method of investigation.

Studying the process of a disease in the living person is known as a clinical study. Clinical studies can be used to verify findings of epidemiological surveys.

Pulmonary emphysema is an incurable respiratory illness. It is the fastest growing cause of death in our nation. There has been about a 20-fold increase in emphysema deaths in the United States since 1960.

The chances of developing pneumonia, an acute respiratory disorder, is accelerated by air pollution. Laboratory experiments consistently prove animals which breathe gases commonly found in city air were less able to combat pneumonia than animals not exposed to polluted air. Pollutants did not necessarily cause the infections, but they did weaken the body's resistance to the germs.

Air pollution creates a strain on the lungs and heart, demanding that the heart pump harder to circulate blood in order to compensate for loss of oxygen. If a person suffers from heart disease, asthma, chronic bronchitis, or other respiratory ailments, the strain on the lungs and heart is even greater. In the form of sulfur dioxide it becomes a hazard to lung tissue and the respiratory system. A six-year study in New York State concluded that approximately 13 percent of the deaths during this period of time were attributed to air pollution. The study stated that sulfur dioxide and other air pollutants added stress on the heart and lungs of people suffering from respiratory ailments and heart disease, thereby causing deaths. After overworking for a period of time, the heart may double in size or even quit, resulting in death.

Lung cancer has also been connected with the different types of pollutants found in the air. In laboratory tests benzeaphrene was given to mice. Lung cancers developed. Breathing small quantities of this one chemical during a 12-hour period is equivalent to smoking 50 cigarettes a day. In

another scientific test hydrocarbons, one of the emissions from automobiles, were transplanted into the lungs of rats. According to the results from these tests the rats developed lung cancer.

Coinciding with the steady increase in pollution of the air, deaths from lung cancer have risen rapidly. Deaths in the urban areas of the United States are twice the rate of those in rural areas.

The upcoming decade may be the time when we begin to reduce seriously the pollution of the atmosphere. No one is exempt from the problems of air pollution. As President Nixon stated in a 1970 speech on the environment, "I have become convinced that the 1970's absolutely must be the years when America pays its debt to the past by reclaiming the purity of its air, its water, and own living environment. It is literally now or never."

Solutions to Air Pollution

As we attempt to seek solutions to the air pollution problem, we must be aware that it is impossible to stop completely all of the harmful emissions which are being dumped daily into our atmosphere; therefore, the solution we seek is to reduce particulate and gaseous matter in the air to levels which will not threaten the safety of man and his environment. How we can reduce air pollution is not simple to answer.

The task of cleaning up our air requires money, time, and effort. No one individual can solve all the problems associated with air pollution. It must be a united effort of individuals, industry, and all levels of government. With all of these segments of our society working together, reduction of air pollution will be accomplished. Many initial steps have already been taken, but there is a long way to go before the situation will be under control.

The Role of Government

Federal guidelines for state government and industry regarding purer air are found in the Federal Clean Air Act of 1967. In 1970 several powerful amendments to this law were passed by Congress, making the act the most far-reaching air pollution legislation in American history. Experts feel adequate provisions for a successful campaign against air pollution exist in the laws.

Under the Clean Air Act of 1970, the national standards are in two parts -- primary and secondary. A primary standard is designed to protect public health. It sets a limit on the amount of a pollutant in the ambient air (the outdoor air around us) that is safe for humans. The Environmental Protection Agency has stated that each city should strive for an

annual particulate count of 60 micrograms per cubic meter of air in order to protect the public health with a margin for safety. The EPA suggests that to reduce the particulate count to the recommended level, states may follow any or all of the following measures: relocating of industrial plants; testing and inspections of emission systems for automobiles; enacting commuter taxes; rationing of gasoline; or staggering the working hours of commuters who work in the city. A secondary standard is designed to protect public welfare. Usually more stringent than a primary standard, a secondary standard sets a limit on the amount of pollutant that is safe for clothes, buildings, metals, vegetation, crops, animals, etc.

The Federal Government now has the power to supervise the individual states as they attempt to reach the air quality standards. It has the right and responsibility to enforce these standards when an individual state fails to do so. If a state's air quality control progress is not workable or is inadequate, the EPA has the right to veto the plan. In such a case the EPA may substitute its own plans.

Another requirement of the 1970 Clean Air Act was to require automobile manufacturers to install a low-pollution exhaust system by 1975. Beginning with 1975 models, automobile emissions of hydrocarbons and carbon monoxide must be reduced by 90 percent from the 1970 emission level. Nitrogen oxide emission by 1976 must be reduced by 90 percent from the 1971 levels.

Motor vehicle emission standards apply not only to new cars and engines made in the United States but also to those that are imported. Manufacturers are required to obtain certification from EPA that their cars meet specified emission levels. To do this, manufacturers test samples of prototypes of new cars or engines, under procedures specified by EPA, and submit the results to the Agency. If the samples tested meet the standards, EPA certifies the family of cars or engines. EPA also may conduct its own tests of new vehicles or engines. A similar procedure covers emission standards for trucks and buses.

Several car manufacturers have asked for an extension of the 1975 deadlines, but the EPA has turned down all requests for extensions of the time limit.

Another example of what federal agencies are doing to detect and limit air pollution is shown in a project of the Defense Civil Preparedness Agency. Radioactive detection equipment has been installed in Chicago and New York City to measure the types of pollutants in the air.

Many states have begun a concentrated effort to combat air pollution by passing legislation which will enable them to carry out federal guidelines as set forth by the Clean Air

Act of 1970. Various agencies have been given the responsibility of controlling air pollution within the states, and, in some instances, air pollution control commissions have been brought into existence. They are frequently charged with the responsibility of issuing operating permits to industry and other sources which might pollute the air, imposing fines on individuals or industries who violate their operating permits, and closing industries when air pollution counts become dangerously high.

What Industry Can Do

Practically every industry in the United States is looking for means and ways to reduce air pollution. Many effective methods are already known, and in the last three years industry has spent an average of $300 million each year to install air pollution control devices. Some new devices can reduce solid particulate emission from factories by 99 percent.

Examples of how industry can improve conditions abound. Pittsburgh's progress will serve to illustrate what can be done. Pittsburgh was once known far and near as "The Smoky City." Today it should perhaps be referred to as "The Smokeless City." Such a drastic change came about due to an anti-smoke compaign that has had revolutionary results. Smoke and dustfall in the Pittsburgh area have been reduced by an almost unbelievable 84 percent since World War II. Before the change, visibility in the downtown area was practically zero with near blackout conditions existing much of the time. Visibility from downtown has improved greatly.

Pittsburgh and Allegheny County had to call upon every element of the community for cooperative effort. Homeowners volunteered to discontinue the use of soft coal. If coal had to be used, they installed smoke preventive fuel burners. Industry agreed to supply the necessary money to reduce greatly or to eliminate smoke emissions from its stacks. Shipping lines volunteered to shift from steam to diesel-powered operations. Over $380 million was spent to bring about this change. Home owners paid about one-fourth of this amount. Industry paid the remaining three-fourths.

Two years after its smoke control program had gone into effect visibility in downtown Pittsburgh had improved 67 percent. There was a 39 percent increase in days of observable sunshine. By 1955 there was a reduction of nearly 97 percent of heavy smoke and almost 89 percent in total smoke since World War II. The annual estimated personal savings amounted to $41 million in laundry and cleaning bills.

Pittsburgh is a good example of what industry and the informed public have done to fight air pollution.

The Role of the Individual

The 1970 Amendments to the Federal Clean Air Act also

provide for the involvement of the individual in combating pollution.

Any private citizen may bring a suit against a company or person who is violating any standards for emission control which have been set by the EPA. Individuals may also sue the EPA administrator if he fails to carry out his duties as stated by the 1970 Clean Air Act.

The Federal Communication Commission has made it possible for citizens or groups who dispute certain advertising information of a company about their non-pollution product to have equal time to rebut their claims. Also complaints from individuals can cause the FCC to make advertisers document claims of their non-pollution products.

CHAPTER SEVEN

NOISE POLLUTION

Introduction

Listen! What do you hear? Can you remember a time in your life when your surroundings were free of annoying sounds? In the past, Americans were able to enjoy the quiet serenity of the countryside without the deafening roar of jet planes or the clanging, clacking, banging, and honking of other transportation and mechanical devices (visual 96). When night came most activities ceased, but this is not the case today. Activity goes on even during the time when we are sleeping. These sounds to which we are subjected may be disturbing and harmful to our health. Sustained listening to loud sounds has been found to be damaging to our nervous system which, in turn, affects our heart and circulatory system.

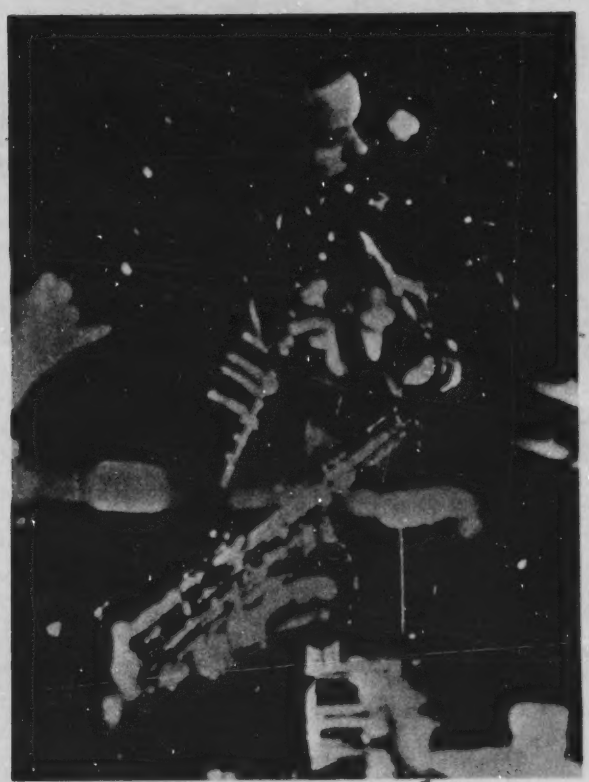
Rock music or similar loud sounds are enjoyed by many people, but they may cause hearing loss (visual 97). This study is not an attempt to ban these sounds, but it is an attempt to make you more aware of the problems associated with sustained exposure to any loud sound. It is also an effort to look at some ways in which we might deal with these problems more effectively.

Noise pollution is a constantly growing problem which in the past was ignored by many; however, people are now beginning to realize the growing threat of this problem.

Sound is created when any matter is set in motion. The motion causes vibrations in the air which are intercepted by a receiving device, such as the ear, and the sound is heard. When does sound become noise? Noise is extremely difficult to classify because it means many different things to different people. What may be noise to one person may be music to another. For example, listening to a blaring radio may be pleasurable to one person while to another it is nerve-racking. Considering all sounds which are noise, we find there are two similarities. These sounds are usually loud and unwanted. The intensity or loudness of sound is measured by a unit called a decibel. Decibels are not linear units like miles or pounds. They are representative points on a sharply rising curve. Ten decibels are ten times more intense than one decibel, 20 decibels are 100 times more intense (10x10), 30 decibels are 1,000 times more intense (10x10x10), and so on. One hundred decibels are ten billion times as intense (that is, represents ten billion times as much acoustic energy) as one decibel. The reason for such a complicated scale is simply that the human ear detects a wide range of acoustic energy.

The normal range of hearing for a human is zero to 130 decibels, but the decibel scale can measure higher sounds. Usually for a sound to be called noise it must range above 85 decibels. Any

Visual 96



Visual 97

sound below 45 decibels is seldom called noise. Normal conversation measures about 60 decibels while that of a diesel truck measures 85 decibels or more. Researchers on noise pollution agree that continual exposure to loud noises can contribute to loss of hearing. For example, exposure to noise levels over 90 decibels for several days will probably cause some permanent hearing loss (visual 98). Already an estimated 16 million people in the United States suffer from some degree of hearing loss directly caused by noise.

Sources of Noise Pollution

Population Growth and Urbanization. The rapid growth of the world's population has resulted in a serious increase in noise pollution. More people make more noise. Most of today's noise is concentrated in the constantly growing urban areas which are alive with the sounds of throbbing industry, moving traffic, shrieking sirens, crowded residential areas, and the many sounds of construction (visual 99).

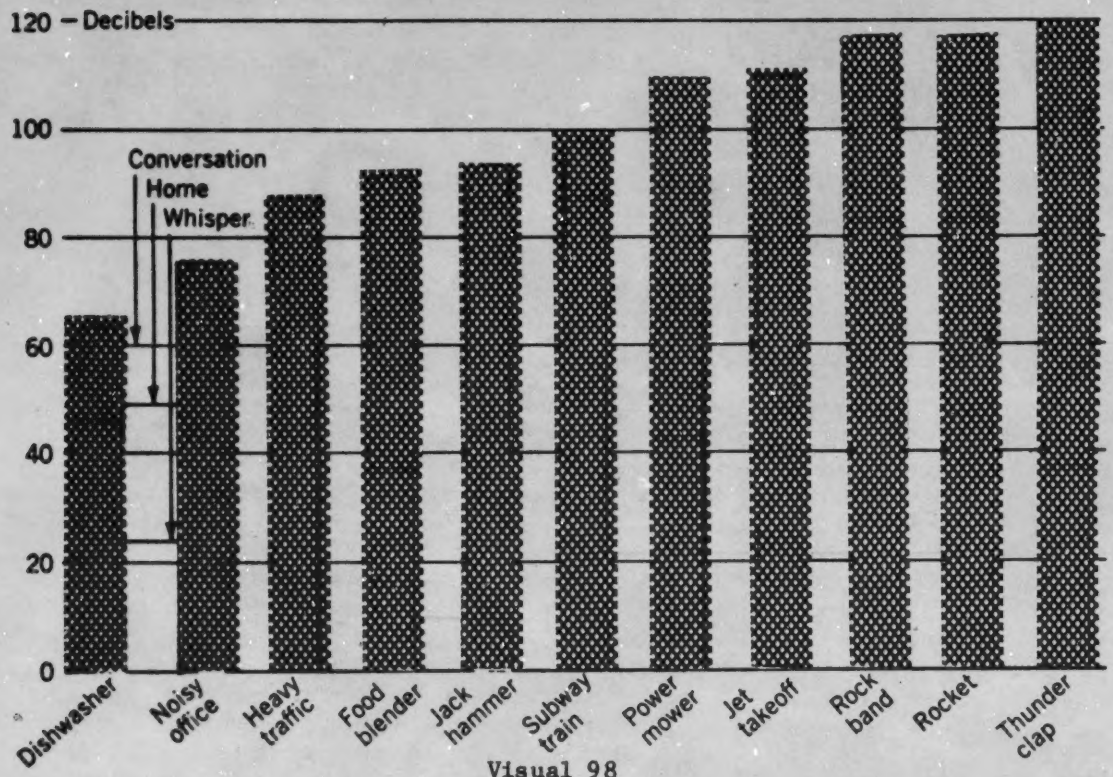
With the growth of the population has come increased needs for transportation, shelter, food, recreation, and occupations. The fulfilling of these needs has also contributed to the rise in noise pollution. At present approximately 75 percent of the people in the world's largest cities are surrounded day and night by some type of noise pollution or sound levels in excess of 90 decibels. This urban noise doubles in intensity every ten years and is fast becoming a threat to mental and physical health.

Transportation. Even from the time of the chariot in ancient Rome transportation has been a major cause of noise. Motor-driven vehicles contribute as much as three-fourths of the noise generated every day in the United States, which is almost one car for every two people. In large cities normal traffic noises may reach 90 decibels. In small towns traffic noise may reach 75 decibels.

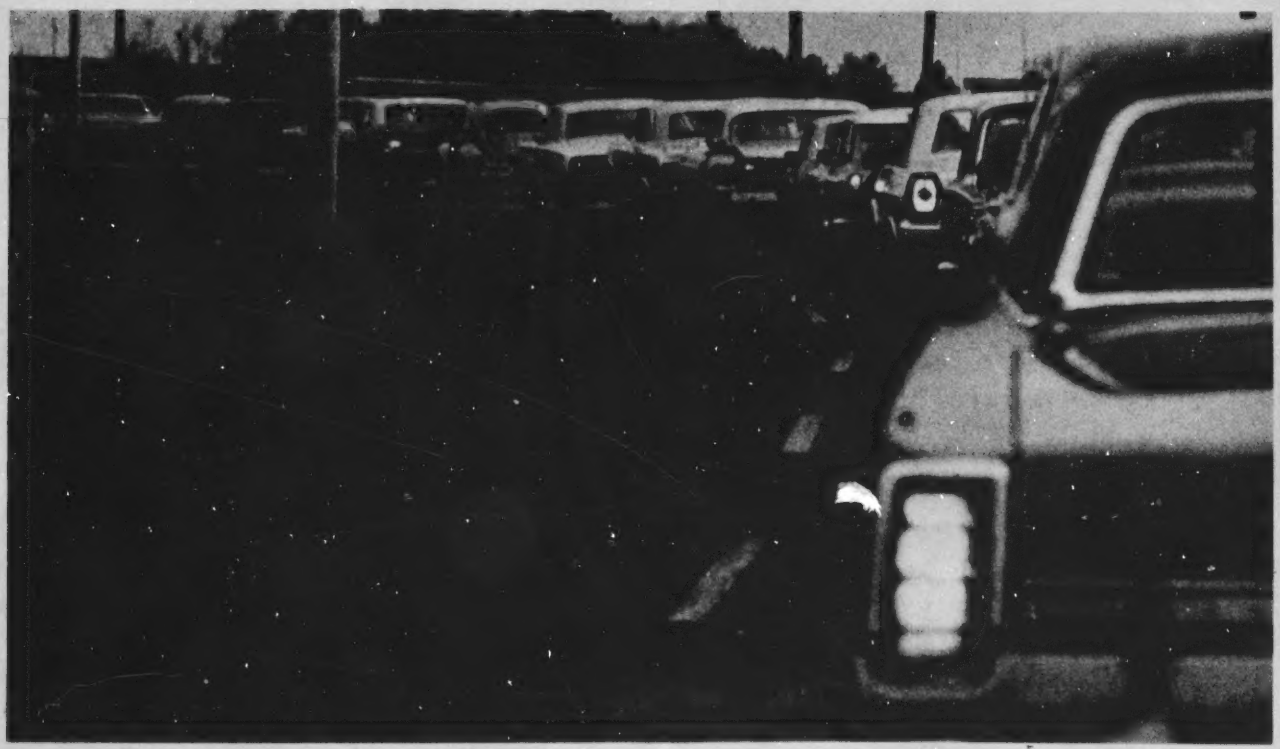
Each year, many modern cars are constructed in order that they will be quieter inside; but something still must be done with outside noises caused by motors, exhausts, horns, etc. Studies show, however, that many people equate noise with power. Such is the case with cars and motorcycles. The fact that they are very loud makes people think they are also faster, and many people will buy them for that reason alone. Motorcycle manufacturers may be slow to muffle their engines for fear the public will buy the more noisy models (visual 100).

Another source of noise pollution is the train. It does create loud noises in urban and rural areas close to the tracks and stations. Subway trains contribute to a high level of urban noise. The sound of steel wheels rolling on steel rails is amplified as much as ten decibels by the reflective walls of the subway tunnel. Previously, noise control has not been considered a factor in the building of subways, but new subways being built in Paris, Montreal, and Berlin are being planned with noise

COMMON SOUND LEVELS



Visual 98



Visual 99

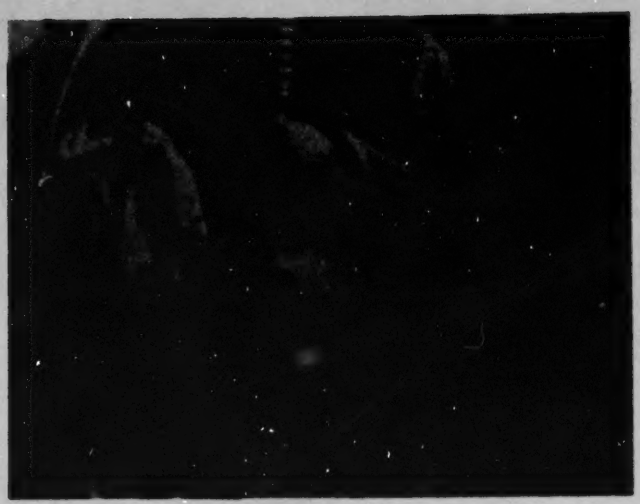
control in mind. Some people are experimenting with rubber wheels in an attempt to reduce noise levels.

Airplanes are another important cause of transportation noise. Cities and towns have grown closer and closer to once isolated airports while the airports were expanding in size to handle the larger and faster aircraft. In some places the airport is completely surrounded by homes in line with the runways where large jet aircraft take off and land. An estimated 13 million people live close enough to airports to suffer from noises created by the aircraft (visual 101). With the demand for faster means of transportation and the development of commercial jet aircraft, the popularity of air transport has resulted in a great increase in the number of such aircraft. This has caused a rapid increase in the decibel level around many of the nation's busy airports. Chicago's International Airport has, on an average day, one aircraft taking off or landing every 60 seconds. Atlanta's commercial airport has a similar average. Such a volume and concentration of high-pitched noises are not only irritating, but there is also the potential for severe physical and mental harm (visual 102).

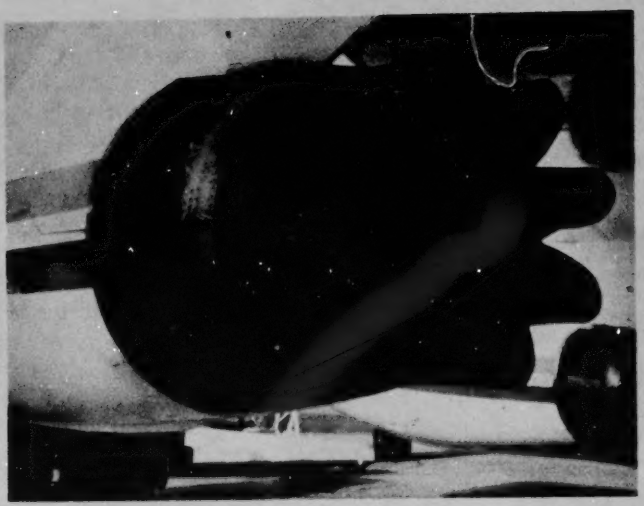
Sonic booms also constitute a noise nuisance. The sudden noise, which usually comes from military aircraft breaking the sound barrier, can contribute to mental fatigue as well if it occurs with any frequency. There is rarely any long-term hearing loss as a result of the sonic booms, but the Supersonic Transport (SST) booms have been known to shatter windows, break dishes and delicate antiques, crack building foundations, and create rock slides.

Residential Noise. People cannot escape from noise by going home. Houses and apartments are no longer havens of peace and quiet. Instead they become very noisy places. Each year homes and buildings are being built closer together because there is less land available for building. When buildings and homes are crowded together, the result is an increase in noise; because crowded neighborhoods mean heavier traffic, congested play areas, overloaded schools, and a reduction in quiet relaxing areas. Part of the reason for this increase in noise around the home is due to flimsy construction and poor sound-proofing; however, a large part of this increase is due to the great number of appliances found in every home. In homes today there are humming air conditioners, grinding garbage disposals, blaring record players and televisions, whirring food blenders, automatic clothes washers and dryers, and roaring vacuum cleaners all running at the same time. This orchestration of appliances makes for the majority of noise pollution inside the home. Outside the homes the noises created by lawn mowers and traffic sounds add to the intensity of residential noise pollution (visual 103).

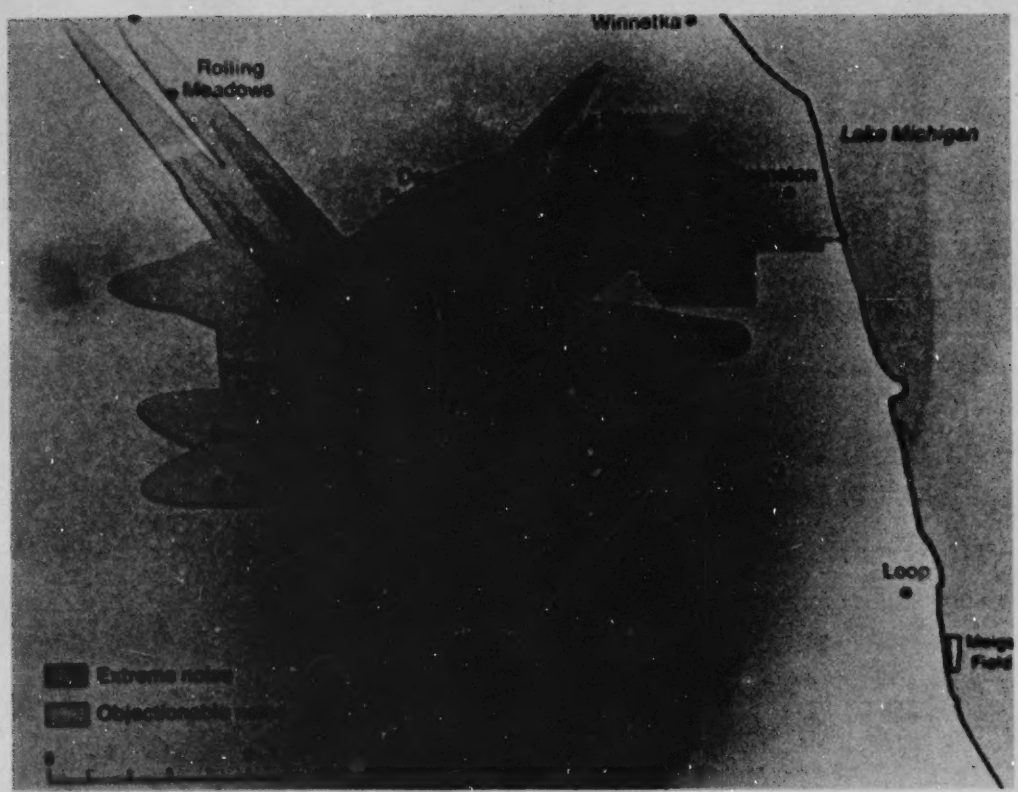
Industrial Noise. During the days when both machinery and cloth were made by hand, noise was not a problem in the production of goods. However, as the Industrial Revolution changed the



Visual 100



Visual 101



Visual 102

making of goods from small shops or home-made products to mass-produced factory-made goods, noise increased. Today at least 17 million people work in noisy occupations, ranging from an automobile assembly plant to the construction of city skyscrapers. A construction worker operating a circular saw may be subjected to 110 decibels. All of these decibel levels just mentioned are above the recommended safe decibel level of 85 which, with sustained exposure, may cause some hearing loss.

The Noise Control Act of 1972 offers some hope that noise levels will be reduced in many formerly high noise level industries.

Effects of Noise Pollution

Everyone needs relaxation and sleep. This is not possible, in many cases, because of the noises which constantly surround us. These noises may be too low on the decibel scale to cause hearing damage, but they can cause undetectable damage in stress, tension, and nervous strain. A common noise, such as a ringing telephone, is a good example of this. It is not a damaging noise, but if it rings constantly, it can cause nervous stress.

There are about 23,000 cilia, or hearing sensors, in the cochlea, that part of the inner ear damaged by loud noises. Prolonged exposure to any loud noise produces fatigue in these cilia resulting in a temporary inability to hear. Rest and the absence of loud noises will allow the cilia to recover. Prolonged noise may cause permanent damage. The first sensors to become damaged are the ones responding to high frequency sounds, and this damage cannot be corrected by surgery or a hearing aid. A recent survey in the United States showed that about five million males between the ages of 10 to 60 suffer some hearing loss. One million of these could be helped by wearing hearing aids. American men in the age group 69-80 have a more serious hearing problem, with more than half needing a hearing aid.

Continued exposure to rock music played at a high volume can cause hearing problems. Bands using amplified sound exceed the safe limit of 85 decibels and many approach 120-150 decibels which causes pain to some people. Studies conducted in isolated areas of Africa (visual 104) where the noise level is very low, found that people living in these areas have almost no hearing problems, even among the aged. According to these studies, men aged 70 and older possess a hearing sensitivity equivalent to that of Americans 30 to 40 years their junior. Diagnosed early, hearing problems can be corrected in most cases. It is just that most people fail to realize that they have a hearing difficulty until it is too late. A person with slight hearing loss may have to ask people to repeat words in conversation, because they cannot hear the words or cannot hear them well enough to understand what was said.

Visual 103

Visual 104

There are conditions where even a slight noise bothers some people; the watchmaker working on a wristwatch; the golfer about to make a ten-foot putt; the surgeon performing a delicate operation. The reason for this is that noise makes the eyes dilate, requiring the person to change his focus rapidly, causing eyestrain and headache.

There seems to be a danger of becoming used to a noise, where people are not even aware of the sound. This may happen in an office where many people are listening to radios; after a period of time they still hear the sound, but they are unaware of it. Doctors are uncertain of the dangers to such continual exposure to background noise. It was found that many men who listened to a car radio after work had to turn the volume higher than was comfortable before work. This suggests that minimal background noises may lessen our sensitivity to even louder noises.

In addition to eye and ear damage, noise seriously affects the heart and blood vessels. The cholesterol in the blood increases and blood pressure is raised. Even a very slight noise can cause small blood vessels to constrict and slow the blood flow.

Emotional Effects. Many times noise which may be neither loud nor unexpected can cause mental stress and strain because it is annoying. A good example would be an office which employs several typists. The constant clack of the typewriters would tend to annoy and irritate some people until they become very tense and irritable. It is easily understood why someone working in such an office might go home in an unpleasant mood. If his home is also noisy, then this combines with the noisy office to make the person tense and irritable.

Recent studies indicate that increased noise in the home causes some of the following reactions among family members: (1) a gap in inter-family communication, (2) irritability, and (3) short attention span and hyperactivity in children.

Continuous sounds which are unpleasant and unwanted, such as sounds near an airport or train track, can lead to frequent anger. Also, people who are subjected to sudden, unexpected noises experience an increase in the heartbeat rate, increased sweating, visual blurring, and a general contraction of muscles.

In a study conducted in London it was discovered that more of the patients in London's mental hospitals were from the area around Heathrow Airport than from the quieter areas of London. This supports the fact that American researchers have found that noise may cause mental stress. They have stated that people who are exposed to unpredictable noises or uncontrollable noises become very frustrated, irritable, and are unable to perform at top efficiency. In some cases the stress, tension, loss of sleep, and resulting nervous strain may ultimately lead to some kind of mental breakdown.

Financial Effects. Noise can have detrimental effects on business and industry. The World Health Organization discovered that noise is costing industry billions of dollars each year in absenteeism of workers and costly industrial accidents, which occurred when workers were unable to hear shouts of warning due to the high level of background noise. A lower efficiency rate among workers was found in some plants with the higher background noise level.

Solutions To Noise Pollution

Noise has only recently been recognized as a pollutant of the environment. Of the three forms of pollution covered in this study -- air, water, and noise -- noise would probably be the easiest to curb. The world will never be completely free from noise, but it can be made quieter by muffling many noises which are distracting or even harmful. The elimination of unnecessary noises, however, will never occur until everyone -- homeowners, businessmen, students, and government officials -- realizes the nature and scope of the noise pollution problem and begins to attempt to control noise.

What Government Can Do. Recognition of the fact that noise is an environmental problem affecting people other than workers has been late in coming. The Clean Air Amendments of 1970 called for the establishment of an Office of Noise Abatement and Control in the United States Environmental Protection Agency. This legislation also called for public hearings of environmental noise and other special studies culminating in a report to Congress. This EPA report and the extensive congressional hearing resulted in the Noise Control Act of 1972.

This Act represents the first major federal attempt to eliminate excessive noise at the design stage of new consumer products. The Environmental Protection Agency was charged with this responsibility, in addition to its identifying and distributing information on techniques for noise control of current products that are a major source of noise pollution.

The law requires standards for products in the categories of construction equipment, transportation equipment (except aircraft), all motors and engines, and electrical and electronic equipment. EPA also has the authority to set standards for other products where it is believed to be necessary for the protection of public health and safety.

EPA may require the labeling of domestic or foreign products as to noise generating characteristics or effectiveness in reducing noise. Violation of these requirements may result in fines up to $25,000 per day for each violation and imprisonment up to one year. In addition to labeling, manufacturers must issue warrants stating that regulated products comply with federal standards at the time of sale, maintain records and information,

and provide production samples if requested by EPA. EPA may certify low noise emission products for purchase by the Federal Government.

In addition to the above provisions, the EPA administrator also prescribes noise emission standards for the operation of equipment and facilities of interstate railroads, trains, and buses.

Controlling the noise of jet aircraft around airports has become an area of much concern. It has been suggested that jet engines be made quieter, that buffer zones of three to five miles around an airport remain undeveloped by realtors, or that airports be built away from residential areas. Although EPA does not have the responsibility of establishing rules and regulations controlling aircraft noise (federal legislation of 1968 made this the responsibility of the Federal Aviation Agency), it has been given the responsibility of completing a study of aircraft noise and noise exposure around airports. Results of this study will then be forwarded to the FAA for consideration.

At the state and local levels, laws tend to treat noise as a public nuisance, and enforcement is difficult. More recently some localities have established new laws and ordinances that are based on the noise generating characteristics of specific machines and, therefore, are easier to enforce. California has recently passed state laws enabling the highway patrol to monitor and fine vehicles exceeding specified decibel readings. Chicago has passed ordinances stating specific decibel limits for noise of its motor traffic. New York City now has building codes which require doors, ceilings, and windows to be properly insulated to eliminate much of the noise both inside and outside the building. The cost of proper insulation would not be substantially higher if the insulating were done in the initial construction.

What Industry Can Do. Industry can do something about the noise by designing and manufacturing quieter automobiles, airplanes, machinery, and office equipment. An example of one product produced by industry that is an attempt to reduce noise in a product is the new rubberized bumpers placed on the metal cans into which trash is dumped (visual 105). The rubberized bumpers reduce the noise by 50 percent. The construction industry is working to reduce noise pollution by the introduction of quieter devices, such as a muffled jackhammer which costs considerably less than the unmuffled kind and produces 25 percent less noise. Tool companies are now experimenting with rotary pavement cutters which are less noisy than their predecessors.

It is estimated that electric typewriters could be made quieter for perhaps as little as 60 cents per machine. Dishwashers have been made much quieter for about ten dollars per machine. Automobile manufacturers are well pleased with their efforts to make cars much quieter on the inside and are now looking at new types of motors which are less noisy. The Wankel

Visual 105

engine is one such engine currently being tested in an attempt to reduce noise pollution levels.

Industry is beginning to spend more money each year on noise abatement programs, because they find that in the course of several years they save money in worker efficiency and safety. It has been proven that workers are absent less and are more satisfied with working conditions in a factory that is quieter.

What You Can Do. Too many people are still unaware of the threat caused by noise pollution. For example, quieter air conditioners were rejected by the consumer because they had a slightly higher price tag. A manufacturer of vacuum cleaners developed an extremely quiet model, but it was rejected by buyers because they related noise to cleaning power.

However, as public awareness of noise problems increases, groups are beginning to take action to quiet the environment. In 1960, England passed strong anti-noise regulations with the aid of a privately organized Noise Abatement Society. Public opinion forced Germany to set limits on automobile noise levels. Some New Yorkers, irritated by the noisy construction of a subway, banded together to form the Citizens for a Quieter City, Inc. The group has been successful in getting the mayor to set up a Task Force on Noise Control. A Boston physicist, bothered by the sonic booms, began the Citizens League Against the Sonic Boom.

Although group action is essential in community efforts, individual action is necessary in beginning the fight against noise pollution. The individual and his concern must be the supporting part to any local, state, or national attempt at noise pollution control. We are all noise polluters in some way. For example, unnecessary racing of engines, squealing of tires when we drive, and the unnecessary blowing of horns could be eliminated. Furthermore, the noises caused by refrigerators, air conditioners, washers, driers, and other household fixtures could be muffled by using drapes, carpets, and acoustical ceilings. It is easy to see that noise pollution control could begin at home.

CHAPTER EIGHT

WATER POLLUTION

The Importance of Water

How important has water been in the history of man? We know that without fresh water man could not exist upon this planet; and, as we explore the fringes of space, we seek to find traces of water vapor on the other planets. The presence of water on other planets would lead us to suspect that life forms may exist there. On earth much of our industrial, commercial, and agricultural activity is located near good sources of usable water. Almost all of the earliest cities developed in river valleys such as the Yangtse in China and the Fertile Crescent area of the Tigris and Euphrates Rivers of present-day Iraq.

It is impossible for large numbers of people to come together and form social, economic, and political organizations without an available supply of fresh water. One of the reasons that our own nation developed so rapidly was the abundant supply of fresh water. Even today it is easy to see the importance of having an abundant water supply for city and industrial growth. For example, America's largest cities have developed on or near dependable water sources. The many lakes, rivers, and streams have always been considered endless reservoirs for drinking, washing, and the dumping of waste materials.

Early attempts at water pollution control were often idealistic but were not practical in application. As a result, today the seemingly endless supply of fresh water has become polluted to the point where the water can no longer be used in some areas.

Supply and Demand for Water

The amount of fresh water available in the United States has remained constant at about 650 billion gallons per day; but with the growth of industry, agriculture, and cities with their resulting need for great volumes of water, the demands for fresh water have increased dramatically. In 1971 more than 415 billion gallons of water were consumed daily in the United States.

Industry now uses at least 13 times as much water as it did in 1900. Approximately one-half of the water used each day in the United States is by industry. In order to produce needed materials, such as paper and synthetic rubber, enormous quantities of water must be used. To produce one ton of paper

more than 50,000 gallons of water are required and 666,000 gallons are used to make one ton of synthetic rubber. To produce one automobile, including all the materials that go into the production, more than 500,000 gallons of water are used. One rayon and nylon industrial plant uses eight million gallons of water daily.

Agriculture also uses large quantities of water to produce crops. Almost 500,000 gallons of water are needed to produce one ton of wheat or corn.

Cities use about ten percent of the water consumed each day in the United States. Because of piped-in water and modern appliances, individuals consume more than four times as much water as in 1900. In one United States city with a population of approximately 700,000 people the requirements for domestic water rose from 65 million gallons of water each day in 1965 to 85 million gallons each day in 1970. Also in the same five-year period the city's industrial water demands increased from 48 million gallons to more than 74 million gallons from public water supplies plus several million gallons from private wells. It is estimated that between 1971 and 1981 municipal, industrial, and agricultural demands for water will greatly increase. WHILE ALL THREE AREAS WILL BE REQUIRING MORE WATER AS THE POPULATION CONTINUES TO EXPAND, THE SUPPLY OF USABLE FRESH WATER IS DECREASING.

In the past nature could handle many types of pollutants by the natural process of decomposition of matter and the large volume of clean water in the rivers, lakes, and streams to dilute the small amount of waste present. However, the remarkable progress of the industrial revolution during the nineteenth and twentieth centuries has resulted in complex industrial waste, a very productive and wasteful agricultural system, and evergrowing metropolitan centers with associated increases in sewage waste. All use vast quantities of water and dump back into our water supply an estimated 50 billion pounds of pollutants per year. For example, a typical American city of 100,000 people dumps more than 63 tons of waste per day into waterways.

In one state, of the approximately 200 million gallons of municipal waste accumulated daily, 40 percent is untreated or inadequately treated. This continued dumping of untreated waste into the nation's water resources has upset the balance of nature in two specific ways. It destroys the life support system of man and it contaminates the water with harmful chemicals or matter which allows diseases to develop.

Algae will grow very rapidly when more than normal amounts of chemicals such as phosphorus, nitrates, and detergents are added to the water. As new algae grow, old algae die. The dead algae provide a very fertile breeding place for the bacteria which may cause diseases such as diarrhea, hepatitis, dysentery, and typhoid. These diseases can be passed on to people who drink the water or eat fish from the water. When

pollution kills fish, the smooth flow of energy to man is in danger of being interrupted; therefore, the fish, birds, and other lower forms of animals are early warning systems for man. Their unusual deaths indicate to man that something is wrong in the environment.

Some Effects of Fresh Water Pollution

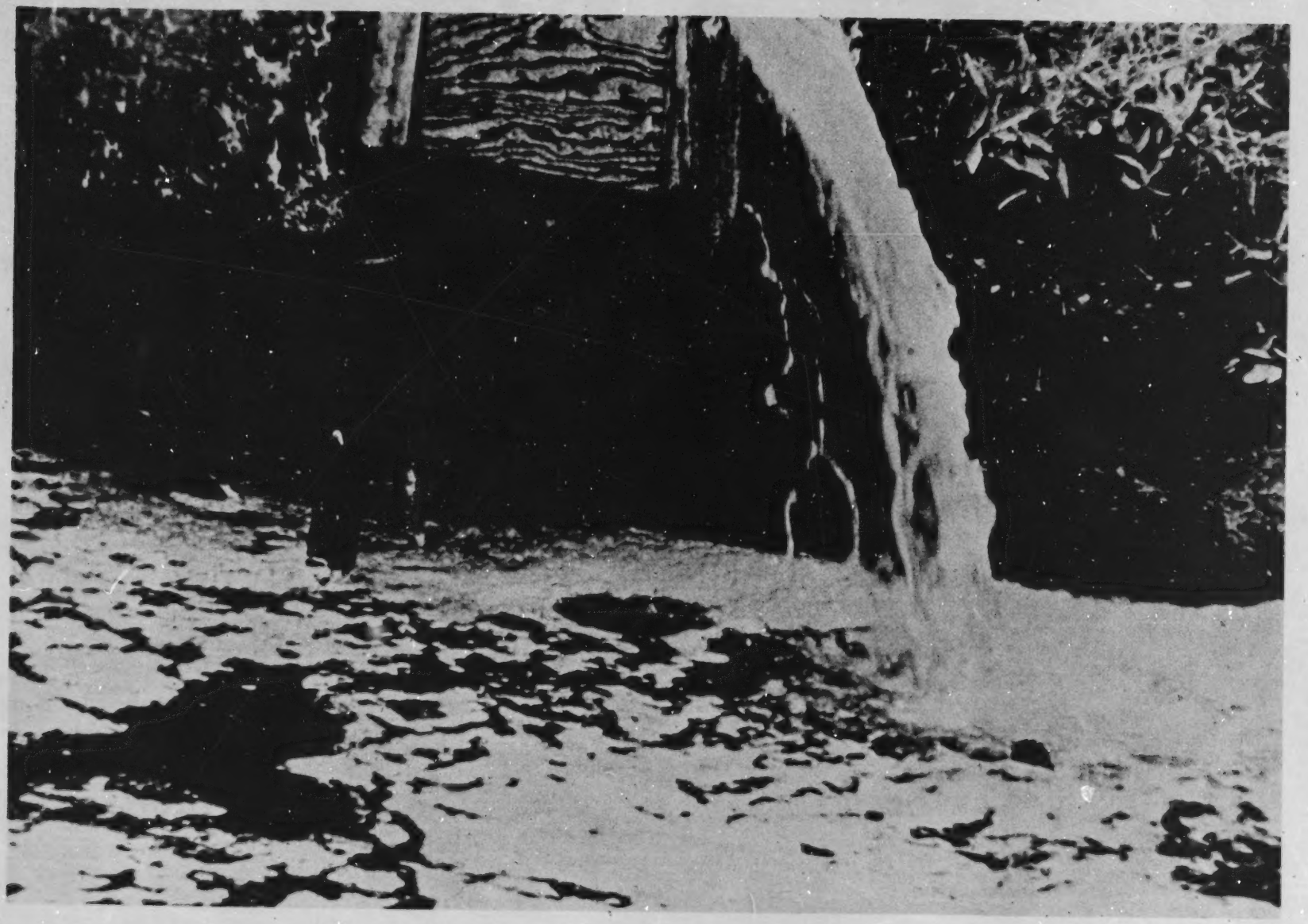
We know that there are many types of water pollutants, and all of these pollutants come from either natural or man-made sources. Decaying plant and animal matter, sediment, and minerals washed into streams by erosion are all forms of natural pollution. In the past nature has been able to cleanse itself of these pollutants, but modern man has added pollutants that resist organic breakdown. Because of this, the man-made rather than the natural pollutants must be seen as the greater hazard in identifying sources of water pollution.

Man's pollution of his water resources is very evident all over the country, and it is affecting people in all walks of life. The Hudson River, which flows through New York City, is much like an open sewer with nearly all the cities and industries along that river dumping raw sewage and waste into it. There are reports that, as a result of pollution, there is so little oxygen left in the lower portion of the Hudson River that a nail when immersed into the water for a period of several months, will not rust. In 1971 a group of children found a watermelon floating on the Manhattan side of the river and took it home with them and ate it. Eight of the children contracted typhoid fever. (Visual 106 illustrates such pollution).

Lake Erie is considered by many to be a dying lake. The amount of commercial fish caught in the lake has decreased from 23 million pounds in 1921 to only 12,000 pounds a year in 1971. Sport fishing has all but stopped; the bluepike, trout, and whitefish have been killed by pollution and have been replaced by more hardy but undesirable fish and leeches. Residents of the lake area are advised not to swim, ski, boat, or fish in the lake. People who want to obtain boat permits are required to have inoculations against certain diseases. Furthermore, the lower part of the Cuyahoga River, which runs into Lake Erie, has been declared an official fire hazard because of its oily chemical content. In 1971 the river burst into flames and damaged several bridges that spanned it.

Identifying Levels of Pollution in An Area

Regardless of whether pollution is taking place in creeks, rivers, bays, or oceans, there is a pattern of pollution that will help us to understand the effects and possible areas of treatment. As more and more pollution waste, untreated or inadequately treated, is dumped into our water systems, the



Visual 106

various pollution areas tend to become larger (visuals 107 and 108). If ten or twenty chemical industries are dumping industrial waste or heated water into a river, then the area of maximum pollution may be one, two, or five miles long (visual 109). If too much waste material is put into a waterway, the water may not be able to get rid of the waste matter before it is dumped into the sea. This type of massive and continuous pollution is the main cause of high concentration of waste material in many of our nation's waterways. The continuous pollution is very well illustrated by the Hudson River, which does not progress beyond state II in purifying itself (visual 109). As a result some authorities say there is a 60,000 square mile area in the northern Atlantic Ocean that is covered by municipal and industrial garbage from the Hudson River.

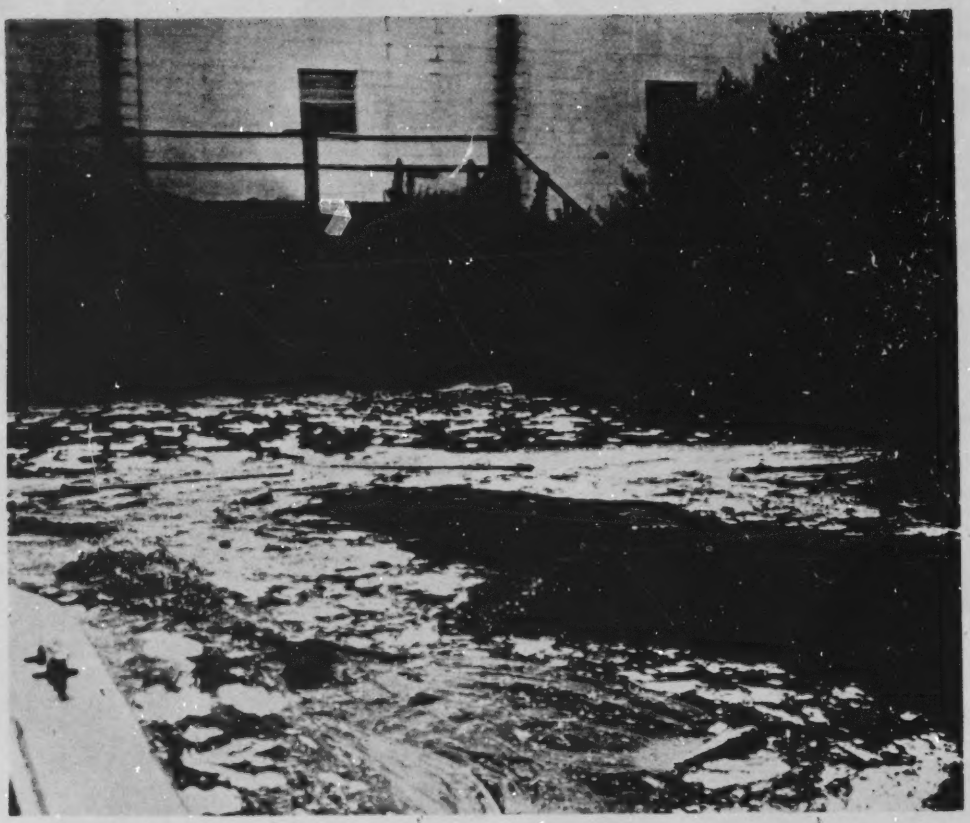
Some Types of Water Pollution

The more serious types of pollutants that we should become aware of include the following:

Trace Metals. There are many different trace metals which our bodies must have in order to be healthy. However, if our bodies absorb larger amounts of these trace metals than we need, they can be harmful or even fatal. There are many trace metals that we come in contact with each day. Mercury and arsenic are but two. However, these two pose the greater threat to our physical well-being and will serve to illustrate for us how metals in our water supply or in food taken from the water can affect us.

The intake of mercury into the human body is very limited when the mercury is in its basic form. It is known that the erosion of certain types of rocks and soils contributes significant natural levels of mercury to both surface and underground waters. However, when basic mercury is exposed to certain common types of bacteria, it is converted to a deadly form, methylmercury. This is absorbed into the tissue of fish. Methylmercury can pass undetected in clear water -- even drinking water -- and result in a threat to mankind. As long as mercury is exposed to bacterial action, more methylmercury will be produced. Thus mercury in the environment for hundreds of years will continue to be converted to the deadly form.

Today many industries use basic mercury in processing. The chemical, plastics, electronics, food processing, and pulp and paper industries are some of the major users of basic mercury. In the pulp and paper industry it has been found that keeping the logs wet while they are in the woodyard helps in processing and prevents insect damage to the stored wood. However, the growth of bacteria and various forms of fungi on the continuously wet logs disrupts the



Visual 107

Visual 108
145

PATTERN OF POLLUTION

I. Maximum Pollution Area

1. Usually occurs around the source of dumpage and usually terminates within two hundred yards of the source around an outlet pipe, etc.

2. Water Oxygen content is at its lowest point.

3. Considerable water discoloration as a result of high pollution concentration.

4. Little or no observable aquatic life.

II. Odor Pollution Area

1. Characterized by odors of decay. Area of coverage is indeterminable.

2. Very low oxygen content in water.

3. Considerable water discoloration as result of high pollution concentration.

4. Observable aquatic life consist primarily of lower forms of worms and some plants.

III. Algae Growth Area

1. Area of coverage indeterminate, but easily recognized as a result of presence of water plants (algae).

2. Intermediate quantity of oxygen available in water.

3. Polluted water is discolored to green or gray-green not from the pollutants in the water, but from plant algae growth.

4. Intermediate life forms, snails, etc.

IV. Final Cleansing

1. Area of coverage indeterminate.

2. High levels of oxygen as result of the high concentration of algae from area III.

3. Very little discoloration.

4. Much observable aquatic life.

146

Visual 109

normal process of paper making by clogging up the equipment. So mercury is used to destroy the bacteria and fungi. In addition to the pulp and paper mills' use of mercury, it should also be noted that the largest users of mercury are those plants which are engaged in the manufacture of chlorine and caustics and which use the mercury cell process. Unfortunately from the pulp and paper mills, as well as the chlorine and caustic producing plants, the mercury usually flows with the water back into waterways without any type of treatment. As a result of mercury waste, several waterways have been closed to commercial fishing. This, in turn, has directly affected the tourist and economic condition of the affected rivers. As the water flows along, a city may draw water from that waterway, put the necessary purification chemicals into the water, and then pipe it to the consuming public as drinking water. The drinking water still contains mercury or, if bacteria has acted on it, methylmercury which has not been affected by the normal purification process. Furthermore, very few water stations periodically check their water supplies for trace metals, especially methylmercury.

The international as well as the national maximum allowable concentration of methylmercury in foods is 0.5 ppm (parts per million). Some ecologists explain that even at the present time most tomatoes, eggs, and meats have a methylmercury content of 0.1 ppm. Most of the methylmercury in our food is there as a result of the food being sprayed, dipped, or placed in fungicides to retard decay.

It is thought that mercury, like arsenic, tends to accumulate in the body and is expelled very slowly over a period of years. Furthermore, man is the only creature in which mercury collects in the brain. In other life forms the mercury is found in the muscles. Once again, when something goes wrong in man's life-support system or when a dangerous element is introduced into the life-support system, a multiplier effect is set in progress. As a result of the multiplier effect, mercury becomes a major threat to mankind. It can cause blindness, deafness, mental disorders, lack of muscle coordination, and death.

Arsenic in our environment is potentially an even greater danger to mankind than methylmercury because it is a known carcinogen or cancer-causing substance. Arsenic builds up in the human body. Like methylmercury, arsenic is found naturally in trace quantities in the environment. However, when larger than normal amounts of arsenic are concentrated in the environment, they become a source of danger to man.

Most of the man-added arsenic in the environment comes from use of this substance in pesticides. The pesticides are sprayed or placed on vegetation. If it rains, the pesticides could easily be washed off into nearby creeks, rivers, or even filter down and pollute below ground water sources.

When arsenic is consumed by man in larger than normal

quantities (0.01 ppm is the recommended maximum consumption level), the first defenses of the body suffer. The liver fails to filter these particles from the blood and irreparable damage is caused to the liver and kidney. After passing through the first line of defenses of the body, the arsenic is stored in the fatty tissues of the body. When a doctor recommends that a person lose weight, the weight loss should be gradual because otherwise too much poisonous material -- arsenic -- is released into the blood system as the fatty tissue is burned up as energy; and it may result in severe damage to some body organs or even death. Also, if the arsenic level remains high in the individual for a prolonged time, then there is the possibility of a form of cancer developing. In addition to arsenic there are other carcinogens such as beryllium, chromium, and a petroleum derivative benseprymé, which are very common in our environment because of their use in industrial processing.

Non-Metallic Chemical Pollutants in Our Water Systems. There are two basic types of non-metallic chemical pollutants, both of which are widely used in agricultural production areas. The first type, chlorinated hydrocarbons, is a group of pesticides to which DDE, DDT, dieldrin, and endrin belong. DDT is the most common. This group of chemicals is very important to us because of their long-lasting kill power on insects. DDT is supposed to be effective for 20 to 30 years. It is as potent for approximately 12 years as when first applied. This half-life index is true of all chlorinated hydrocarbons.

To illustrate the long life and cumulative characteristics of chlorinated hydrocarbons, a scientist conducted a study of a swampy area that had been sprayed for 15 consecutive years with DDT for mosquito control. Up to 25 pounds of DDT per acre were found in the top layer of mud.

In many states DDT has been used as an insecticide for the last 25 to 30 years. Rains have washed DDT into rivers and streams and underground water sources. With the multiplier effect taking place, fish, birds, animals, and even man himself have been affected by chemicals through the intake of food and water. It is important to note that many of these areas obtain their drinking water from rivers and wells. With the cumulative effect of this group of pesticides it is likely that many, especially rural, sources of water supply are contaminated. It is also important that we realize that hydrocarbon insecticides also accumulate in the fatty tissues of our bodies. Thus large people usually will have more chlorinated hydrocarbons in their bodies than thinner people.

The second group of pesticides is the organic phosphates. This group includes parathion, malathion, azodin, TEPP, and others. These chemicals are also widely used in agricultural areas because they are very poisonous to the insects, but they also have the added advantage of dissolving into harmless

substances in the environment, usually within three months after use. Yet this group, like the chlorinated hydrocarbons, is very difficult to detect in water. In fact, rivers, streams, creeks, and subsurface ground water often transport the pesticides out of the area where they are used to possible areas of human consumption. Traces of pesticides have been found from the Arctic to the Antarctic and from the Atlantic to the Pacific. In a remote area of Arctic Alaska a team of amateur ornithologists (people who study birds) found varying amounts of chlorinated hydrocarbons in nests and eggs of all specimen they examined. Although never used in the Antarctic, traces of DDT have been found in the tissues of four species of animals. The eelpouts, one of the four species studied, showed the heaviest concentration of DDT and they had been captured in traps that were approximately 1,500 feet deep in McMurdo Sound. In a study of the Bermuda petrel, a flesheating bird that feeds at the end of ocean food chains in the Atlantic, it was noted that the birds were having difficulty breeding. It was determined that breeding difficulties could be attributed to the substantial traces of DDT in their eggs. From the Pacific area a research team collected over 400 samples of fish, shellfish, and other invertebrates in an area from Seattle to the Galapagos Islands and from San Francisco to Hawaii in 1966. From these Pacific Ocean samples only <u>four</u> out of the over 400 were free of pesticide.

<u>Pollution from Petroleum</u>. Because of its importance as a fuel, petroleum has become one of the most sought-after natural resources in the world today. Petroleum is the most transported fuel, moving primarily by means of transport. In the process of acquiring and shipping petroleum, more than half a million tons of petroleum are accidentally dumped into the water every year. The intentional dumping of petroleum into the water is a direct result of its use as a ballast to keep the ships level. Once the ships reach port, there is no longer a need for the ballast; thus, it is dumped into the water so the ballast tanks can be cleaned. Once dumped, petroleum is very difficult to eliminate or break down. Furthermore, once it gets into the water, it can float great distances. As it moves along the surface, there is the ever-present danger of fire. It coats the shoreline damaging transport facilities, crops, and wildlife.

One of the most disastrous incidents of oil spillage occurred in March, 1967, when the tanker, Torrey Canyon, ran aground on a reef off the coast of Cornwallis, England. Some 60,000 tons of oil poured into the sea. When the remainder of the ship was bombed, an additional 118,000 tons of oil were set on fire. Beaches were contaminated as they prepared for the summer holiday season, aquatic life was eliminated in some areas, and approximately 30,000 seabirds died as a result of the oil spill.

The "blowout" of a well drilling operation along the Santa

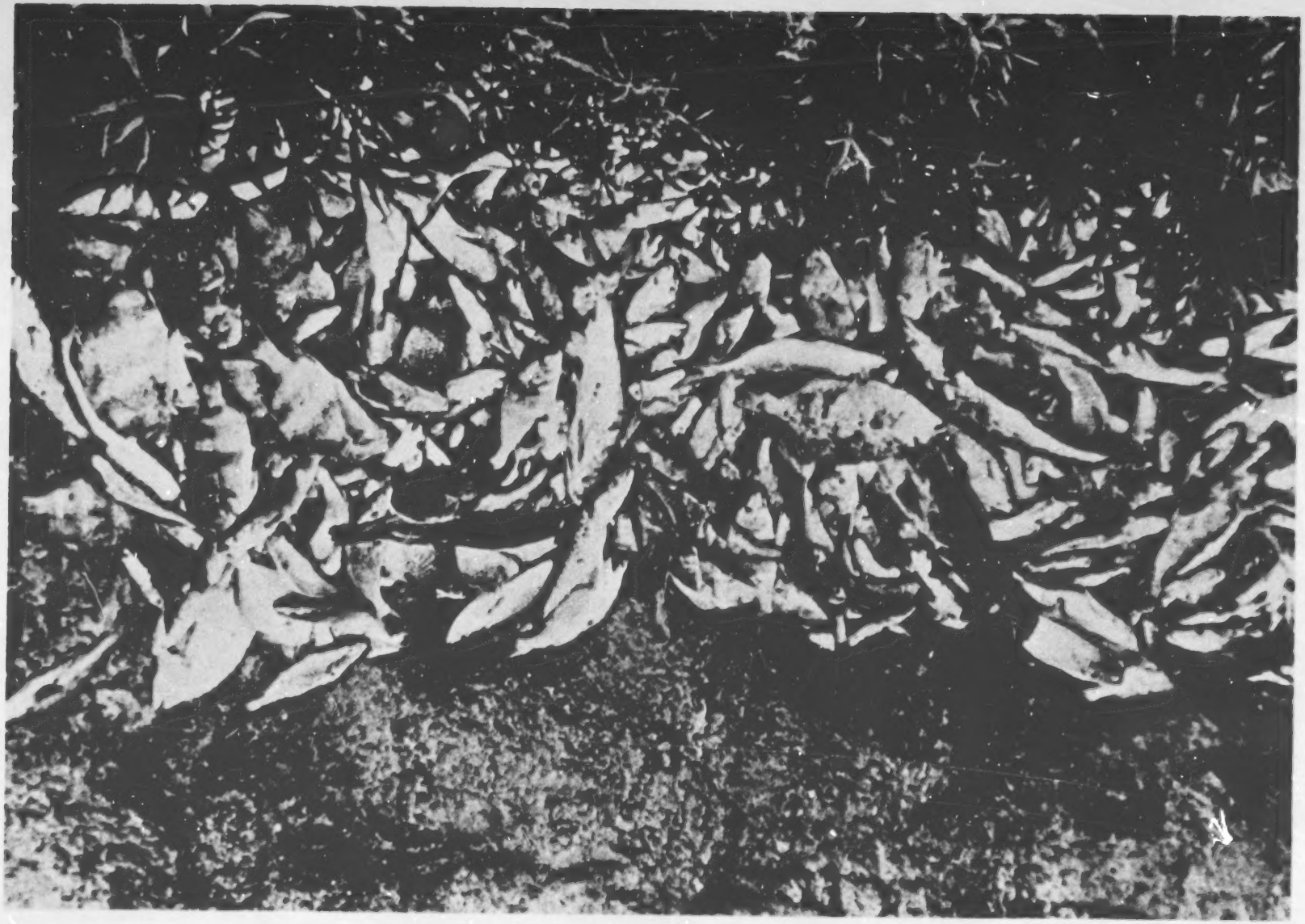
Barbara, California, coastline created an oil slick for 20 miles along the coast and 40 miles out to sea. Marine life was affected, approximately 3,600 birds were killed, some coastal residents were forced to leave because of the odor, and recreational areas were ruined.

The greatest danger from petroleum pollution is to the aquatic life upon which man depends for food and the generation of oxygen. The ocean is the biggest supplier of oxygen on the surface of the earth. When surface feeding fish swim into floating oil, their bodies and gills become coated. Many die and are made unfit for human consumption because their flesh absorbs the floating oil. As the petroleum mass moves landward, toxic oil particles can bring death to the marine life forms that inhabit the shallow areas near the shore. Furthermore, beds of seaweed, valuable as a direct source of food, can be killed.

In addition to killing the fish (visual 110) and other forms of aquatic life, there are the more common threats to man in the toxic chemical, bensepryme, which man may contract through contaminated water or aquatic life (fish, clams, shrimp, etc.).

Oil spills and dumping in the past have been treated with detergents, emulsifiers, sinking techniques, and burning. None of these methods is totally effective since they only change the form of pollution. The method of vacuuming is being improved, and a Canadian firm now has an invention which uses an absorbent conveyor belt to take up the oil. Rollers are placed at the end of the conveyor to squeeze the oil back into drums. To cope with the problem of emptying a ship's ballast, experimentation is being carried out with microbe germs which can be released before the ballast is emptied. These microbes break down the oil into carbon dioxide, sugars, waters, and proteins. The microbes starve to death once the oil is gone and the ballast can then be released without polluting the waters with oil.

Sewage. Cities and towns dump an estimated 25 percent of all the pollutants that go into our water supply. The Los Angeles area of California dumps several hundred million gallons of sewage into the ocean daily. These wastes must be controlled, or they will deplete the oxygen in the water and cause the fish to die. Sewage acts much like detergents and fertilizers in stimulating algae growth. Sewage contains many infectious organisms and parasites which are carried into ground and surface waters. Anyone coming into contact with the bacteria and parasites either by drinking, swimming, or fishing may contract the disease. Since we are dumping large quantities of sewage into the water supply every day, only modern disinfecting techniques protect us from typhoid, cholera, or hepatitus epidemics. In September of 1971 over 3,500 people became ill from contaminated water in Pico River, California, when a chlorinator



Visual 110

broke down.

Our recreational areas are also in great danger of being destroyed by coliform bacteria in the water. The coliform bacteria are generally found only where human waste is found. According to proposed federal standards for a safe bacteria count, the surf off Waikiki Beach in Honolulu, Hawaii, has on several days been twice as high for safe swimming as it should be. The coliform bacteria count in the Potomac and Delaware Rivers has been recorded at 433 and 205 times the recommended safe levels.

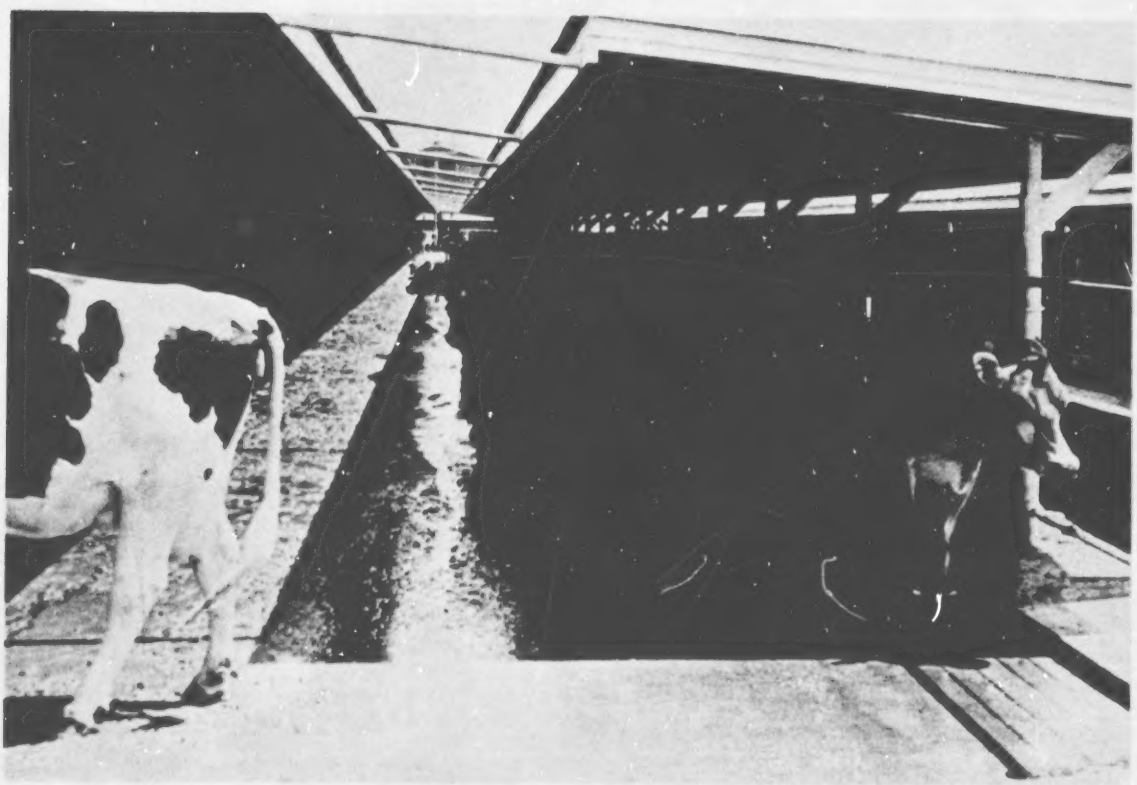
A new aspect of the sewage problem is currently under examination -- problems associated with rainwater runoff into city sewage systems. A study by the White House Council on Environmental Quality has shown that rainwater runoff in some cities contains large quantities of lead, mercury, and other toxic substances. Discharges into sewage systems are sometimes 40 to 200 times greater than allowed by industry. A possible solution would be to trap the first inch of rainfall and apply the same sewage treatment procedures that industry must follow before rainwater is released into the waterways.

Detergents and Fertilizers. Detergents and fertilizers are similar because the phosphorus in detergents and the nitrogen in fertilizers act as stimulants to the algae and other aquatic plants, causing them to grow rapidly. This enrichment process will eventually cause a lake to become a plant-filled bog. After many years the bog will become dry land, and the lake will cease to function as a water resource. Both of these pollutants are resistant to breakdown and removal by the ordinary treatment process. In fact, they change organic forms of these nutrients into mineral form which can be more easily used by plant life. The resulting rapid growth of plants clogs machinery which must be repaired. Furthermore, this type of pollution requires expensive chemical counteraction to correct the chemical and vegetative imbalance which occurs.

Concentrated Livestock Waste. With an increasing population plus a high standard of living, people have come to demand more meat. In order to supply this meat demand, livestock is being raised more quickly and efficiently in feedlots where several hundreds of thousands of cattle, swine, or sheep are concentrated. The feed is then brought to the livestock or poultry making the animal an efficient food machine. One dairy which milks 500 cows twice a day has an extremely large accumulation of waste. The average cow produces 45 pounds of waste a day (visuals 111 and 112).

A city of nearly ten thousand people is located about three miles downstream from a very large poultry-producing area in which large quantities of untreated manure are washed into streams and creeks which empty into the river from which the

Visual 111



Visual 112

city formerly drew its drinking water. Because of this high concentration of untreated animal waste, the city must use seven to nine times the normal level of chlorination to purify its drinking water.

Thermal or Heat Pollution - The types of water pollutants we have studied previously have had a direct impact on man's physical well-being and on local economics. Thermal pollution is believed to pose little, if any, direct threat to man's health, but it does present a serious problem to his economy. Electric power plants, the source of all our electricity, are also the main source of thermal pollution. These power plants use water, coal, petroleum, or nuclear fuels; and it is the energy from these fuels that turns the turbine blades. As the turbine blades rotate, mechanical energy is produced and converted by a generator to electricity for the home. HOWEVER, A LARGE QUANTITY OF ENERGY IS LOST AS HEAT WHEN IT GOES THROUGH THE VARIOUS STAGES OF CONVERSION. When an electrical appliance is used, it becomes warm. This is a result of reconversion of electrical power to mechanical power. If 2,000 pounds of coal energy were used to generate electricity, nearly 50 percent of the coal energy would be lost as heat. As a result something must be used to cool the machinery. This something is water. All of our power plants are located near rivers so they will have an adequate supply of water for cooling purposes.

In America, with the development of more industry, the concentrating of most of our people in large towns and cities, and the ability of the average family to purchase electrical appliances, there is an ever increasing demand for electrical power (visual 113). With the demand for more electricity there is the need for more coolant-water.

Average Annual Demand by a Family of Four in Alabama in Given Years	Years	Number of Alabama Energy Generating Plants
1,100 KWH	1935	10
1,400 KWH	1940	11
1,838 KWH	1945	11
3,024 KWH	1950	11
5,113 KWH	1955	12
8,588 KWH	1960	13
11,602 KWH	1965	17
15,470 KWH	1970	21
Estimated 22,134 KWH	1975	24

(Visual 113)

It is now estimated that 75 percent of all the thermal pollution going into our waterways is from energy-generating plants. When there are several energy-generating plants plus numerous factories along one river, the effect can be startling. For example, the Mahoning River in Ohio frequently has winter

temperatures of 90 to 100 degrees F., and on occasion the temperature has risen above 130 degrees F. while snow and ice covered nearby land.

As the water from an energy-generating plant is returned to the river, the high temperature has deadly effects on aquatic life. With approximately each 20° F. increase in water temperature the body processes of the aquatic life tends to double. Thus, if the temperature increase is very great, the fish, clam, oyster, shrimp, or other aquatic life form will perish because of the prolonged strain on the body.

The high temperature of the water also affects other phases of the aquatic animal's life. For example, most fish lay their eggs beginning in the spring of the year. Obviously the fish do not know that summer is coming, but through temperature changes in the water they know when to lay their eggs. If the water is too warm, the eggs may be laid prematurely and die. Temperature of the water also affects the appetite of the fish. Why is it that the fish seem to be biting best in the early morning or late afternoon? It is directly related to water temperature.

Important and large fishing areas can be destroyed by thermal pollution. This destruction can result in economic depression of an area which may have been economically secure but now becomes a burden to society because the source of income has been destroyed.

Fresh Water Pollution and the Pollution of the Oceans. There are other types of water pollution, including acidity which occurs wherever coal is mined. A salinity problem occurs whenever the flow of fresh water is too small to keep salt water out or whenever too much water has been drawn from underground sources and sea water seeps in. Salinity is a major problem in California, Louisiana, and southern Florida. There are many other types of water pollution, but to name endlessly each type and explain its effect on the environment and man would be meaningless. What is more important is that we need to realize the effect that fresh water pollution is having on man's main source of new oxygen and on his reserve sources of food, both of which come from the oceans. Furthermore, we need to be aware of what can be done to protect or maintain our earth in order to keep it habitable.

Fresh Water Pollution's Effects on the Oceans. The difference between high tide and low tide in a particular area may be as small as a few feet or great enough to include hundreds of square miles. The difference is smallest in hilly or mountainous areas, and the largest areas occur in low or flatlands. Maine, Connecticut, and the State of Washington are examples of the small areas between high and low tides; eastern Texas, North Carolina, Georgia, south Alabama, and Florida are examples of large areas exposed at low tide.

Whenever exposed land is found and there is sufficient

moisture, plants will soon cover the bare soil. The same is true in large areas between high and low tide. Hardy types of grasses which can withstand the salinity of the water soon cover the exposed areas. Over a period of time the grasses die and decay and in decaying release organic materials, protein, minerals, etc., which make food for simple animal forms. As a result of the great abundance of food most types of aquatic animals that are important to man breed in these food surplus areas. Because of the large numbers of smaller animals found there, larger aquatic animals are attracted since they live off the smaller animals.

It can be estimated that most of man's present and future seafood supply comes from the first ten to twenty-five miles of water offshore; therefore, when man pollutes his fresh water supply, this polluted material is eventually dumped into the sea near the land.

What effect is this having on the breeding grounds of aquatic life? Military pilots returning from training flights over the Gulf of Mexico report that the water next to the land is discolored. What does this mean?

As the aquatic life is forced out from the fertile edges of the sea, we must realize the danger it poses to man's oxygen supply. If the animal portion of the food chain is in danger, what about the plants which are the basis of all life on this planet? Are they being destroyed?

Some Solutions to the Water Pollution Problem

The first step in solving water pollution problems is to find out what organizations and technical resources are available to help restore a balance in the environment. Secondly, we must decide whether it is necessary to eliminate pollution completely or if the objective should be to reduce offensive odors, tastes, and water colors to a level that would make it safe for human consumption.

Government's Role in Solving Water Pollution Problems

Effective pollution control must start with organizations that have legal jurisdiction over not only the source of water pollution but also the affected areas. The only organizations with such authority are the federal, state, and local governments. Numerous laws have been passed on the national and state levels in an attempt to control water pollution. The latest law, the 1972 Water Pollution Control Act, is one of the most comprehensive and potentially effective water pollution control acts passed in the history of the United States. For the first time the 1972 Act extended the national program to all navigable water bodies in the United States. Intrastate

waters, as well as previously covered interstate waters, are now controlled by federal legislation. Also, systems of national effluent limitations and national performance standards for industries and publicly owned waste treatment plants have been created for the first time.

The 1972 law proclaimed two goals for the nation: first, that wherever possible water should be clean enough for swimming and other recreational use and clean enough to protect fish, shellfish, and wildlife by July 1, 1983; and second, that there should be no more discharges whatsoever of pollutants into the nation's waterways by 1985.

Why then is there such a major water pollution problem in spite of numerous anti-pollution laws? Lake Erie, believed by many to be a dying or dead lake, is a good example. Four states and one Canadian province connect with this lake, but each state and the province have regarded the lake as their own private waste disposal area. Each has dumped tremendous quantities of waste into the lake. Now it is estimated that it will take at least 100 years for the balance to be re-established in Lake Erie. Why did this happen if there were laws against the dumping of waste into the lake? Many people think they have the answer. The private citizen who formerly fished in the lake would say industries killed the lake. The industrial representative would say city waste (sewage) killed the lake. Who is to blame? Why were the laws not enforced?

Lack of operating funds has greatly hampered the enforcement of the existing laws. While thousands of dollars are needed on the state level and millions of dollars on the national level, more federal monies may not be the answer.

The national and state governments are now moving to make pollution control a higher priority within the various agencies. When this occurs, there are many additional things the governments can do. Some of these will be examined in the following pages.

Comprehensive River Basin Water Standards and Pollution Control

Only the national or state governments have the overall perspective to prepare and support comprehensive river basin pollution programs. To illustrate how such a program would work, imagine that a river flows through unused forest lands from its point of origin to a city along the river which requires large quantities of drinking water. In the river basin, therefore, water standard and pollution control program standards would be set up at various stages along the river. When the river reaches the city, there would only have to be a minimum of water treatment because of safeguards controlling water pollution upriver.

As the river flows to cities farther downstream, extensive

waste control measures would have to be maintained so that the additional cities would have a source of drinking and industrial water.

At various points along the river basin, some water may be used for irrigation of agricultural lands. The quality of water would not have to be as high for agricultural purposes. In a similar way, wildlife areas would not require a high quality of water.

Thus, the entire basin is under the control of one agency. That agency could control pollution all along the basin so that, hopefully, no one city would have to use more than normal water purification measures. This is the type of plan that is being given serious consideration in many areas. There has been no satisfactory solution to the problem as yet because of the involvement of many local governments.

Government Research

The United States Government has access to the necessary technical skills, laboratories, and financial support to maintain research. The highly trained men and equipment of NASA are being used to solve some of our water pollution problems. It has been suggested that some ways in which the government can contribute to solving pollution problems are expanding enforcement activities, establishing public information centers to keep people informed about the laws, and taxing polluters until corrective measures are taken. Government and industry must cooperate in perfecting water pollution control measures and devices.

Industries' Role in Solving Water Pollution Problems

Industries are designed to make profits. As a result American industry continuously looks for potential market areas for its products; and, when it finds markets, much research is done to make the product the best or the most attractive available in that area. There is continuous research to keep any advantage possessed by an industry in the market area. Many industries, therefore, are leaders in developing water pollution control measures.

One steel plant in southern California supplies low price steel to the developing Los Angeles market. The city requires almost all of the available water for domestic purposes. As a result of the locational advantage, the steel company modified its cooling system so that liquid sewage from the city could be used for cooling of the furnaces. Waste water was used, and the heat of the furnaces helped to speed up the decay of the organic waste in the sewage.

Another steel mill on the east coast found that it was also facing water shortage because of rapidly expanding urban areas. The steel mill modified its cooling system so that seawater could be used -- the first time salt water was used for cooling in a major industry in the United States.

Industrial concerns have also developed water treatment systems which can reduce all common pollutants, even mercury.

Some of the agricultural industries have found that tons of animal waste can be processed to produce a very important resource -- methane, or what is normally called natural gas. One scientist reports that the average 2,250 tons of waste produced daily by approximately 100,000 cattle could generate enough natural gas to serve the needs of a city of 25,359 people.

The above examples point to what extent industries will go to try to maintain a favorable location. The examples also illustrate that industries know more about the limits of technology as applied to their production. The steel plant using seawater had the best knowledge of what changes would have to be made to make their processing adaptable to the area in which they were going to locate. Industry has well-equipped laboratories and the trained personnel to develop ways to control pollution caused by their particular waste.

Many industries have invested millions of dollars in research and control of water waste. The main problem is the very high cost of installation and maintaining the filtration systems. Should we expect industry to pay for it? Because of the expense and the fact that industries are serving mankind with products and processes, the central question must be should the individual be willing to support industry in its pollution control activities?

Municipalities' Role in Solving Water Pollution Problems

The dumping of raw or untreated municipal waste into waterways is one of the greatest water pollution problems. The upgrading of treatment facilities is the best way to eliminate the municipal waste problem.

In an attempt to eliminate the phosphate detergent problem some cities have imposed immediate bans on the sale of detergents with phosphate. With additional research it is very likely that some substitute will be found. As a consumer of phosphate detergent we must ask ourselves if we are willing to accept less "whiteness" in our clothing.

The Individual's Responsibility in Water Pollution Control

Governments, industry, and municipalities are made up of

individuals. Just as each student in a room is an individual, he is still part of a class. Each student, therefore, will have to decide how much effort he wants to put forth in helping to make and keep the environment an enjoyable place in which to live. In three years most of the members of this class will be eligible to vote in the next presidential election. Before a vote is cast, most voters will seek to find out all they can about the candidates. The same is true with pollution. Once the individual has the facts, then it is up to that person to make a decision.

Many groups have been formed that offer participation in working for a better environment. The Sierra Club, National Wildlife Federation, and many other organizations have taken a positive stand in making people aware of the possible dangers to our environment. The determined stand of environmentalists against the proposed trans-Florida canal and the Alaskan oil pipeline has focused enough public attention on these projects to cause a review of their possible harm to the ecological balance in the affected areas. Because of this concern the trans-Florida canal has been cancelled; and, until the energy crisis and oil emergency in 1974, there was some question as to whether oil companies would be given permission to build the Alaskan oil pipeline.

These environmental organizations bring law suits to preserve and protect the quality of our natural resources. The Sierra Club is particularly active in initiating court suits to protect the environment. Just recently a suit was brought by the Club to force mining companies to stop building entry roads through the redwood forest areas of California. The Sierra Club and other conservation groups seek to protect the environment through alerting the public.

Most of the fish kills in the state have been reported by fishermen. They in turn alerted the proper authorities who in many cases were able to prevent more fish kills. One individual in action can do much to preserve the environment.

Other individuals have initiated drives to clean up river banks and clean out rivers. Know the laws. The freedom of one individual stops where he infringes on the freedom of another.

The above examples are only a few of the things that can be done. Once again it is necessary to repeat that priorities are of vital importance.

Perhaps the need for us to demonstrate concern was best expressed by Adlai Stevenson, former United States ambassador to the United Nations, in a speech before that body in 1956 when he said, "We travel together, passengers on a little spaceship dependent on its vulnerable resources..., preserved from annihilation only by the care, work, and love we give our fragile craft."

CHAPTER NINE

ENERGY

The demand for energy is increasing at an accelerating rate because the United States is the most industrialized nation in the world. While it took a half century (from 1900 to 1950) for our annual total energy consumption (expressed in barrels of oil per day) to increase from 4 million to 16 million, it took only 20 years for that 16 million to increase to 32 million. If we should continue to increase energy consumption at these rates, we could hit the equivalent of 64 million barrels per day by the late 1980's. This tremendous increase in demand has rapidly outdistanced the available domestic supply. Energy conservation has become a must. Blackouts and brownouts reflect the acuteness of the shortage of electric power. The President's request in 1974 for a five percent voluntary reduction in energy consumption was an indicator of the national priority. We must search out new sources and examine innovative techniques that will assist in making available the additional energy this nation needs.

The major sources of domestic energy during 1972 were petroleum (46 percent), natural gas (32 percent), coal (17 percent), hydropower (4 percent), and nuclear power (1 percent). By the end of this century nuclear power is expected to provide 60 percent of electricity generation and 30 percent of the total energy.

By 1985, if present trends are allowed to continue, the United States would have to import from 50 to 60 percent of its total oil supply, and 30 to 40 percent of this may have to be from Eastern Hemisphere sources.

The offshore areas of the United States are estimated to contain 186 billion barrels of crude oil and over 844 trillion cubic feet of natural gas resources, which are recoverable with existing technology. These amounts represent approximately 40 percent of the nation's total undiscovered oil and gas reserves and offer promising opportunities, since most onshore areas have already been explored and developed.

The discovery of oil in Alaska was announced in February, 1968. Current estimates are that there are 10 billion barrels of proved reserves on Alaska's North Slope. Now that construction has begun, two and one-half to three years will be required before delivery is possible. Initial production will be 600,000 barrels per day, rising to two million barrels per day in five years.

Oil shale is the most significant energy resource known to exist in the world, with possible resources exceeding two trillion barrels of hydrocarbons contained in the sedimentary formations of the Rocky Mountain States, specifically Colorado, Utah, and Wyoming. An estimated 600 billion barrels of oil could be

commercially produced from oil shale under technological development already achieved, of which 80 billion barrels are easily accessible.

Of the 11 million acres of land containing oil shale deposits considered to be of potential commercial value, some 8.3 million acres (about 72 percent) are owned by the Federal Government. These are primarily "public lands" managed for multiple-use purposes by the Department of the Interior.

In 1972 production of bituminous coal and lignite was estimated at 590 million tons, compared with 603 million tons in 1970. At present rates of consumption, known reserves could supply the nation's energy needs for at least 300 years. Coal presently supplies less than 20 percent of our energy demands. Production has remained relatively level over the past several years despite rapidly increasing energy requirements. This stagnation has been attributed to some degree to health and safety standards, environmental restrictions on the sulphur content of coal, possible restrictions on strip mining, and, until recently, price controls.

Geothermal energy is the natural heat of the earth. Water and steam serve to transfer the heat to the earth's surface. These areas of heat concentration may be tapped and utilized as a source of energy.

It is anticipated that about 4,000 MW (megawatt) of geothermal electrical capacity will be available by the year 1985. This is less than one percent of our total energy needs. By the year 2000, geothermal energy is expected to contribute as much as 1.5 percent to our total energy needs. Technological breakthroughs may increase the contribution of geothermal energy to our total power supply.

The world's first nuclear reactor achieved initial operation in Chicago on December 2, 1942, launching a new technology. By 1973 there were 30 nuclear power plants in operation, 60 were under construction, and 75 others had been ordered.

Nuclear power, now providing about one percent of the nation's electricity, will account for up to 25 percent by 1985, and up to 60 percent by the end of the century. Thus, the current nuclear capacity of about 14 million KW is expected to grow to 1.2 billion KW by the year 2000.

The research and development phase of the solar energy problem will increase from an expenditure of $4 million in 1973 to $12 million in 1974. The program will be administered by the National Science Foundation and will emphasize the development of solar energy for:

Heating and cooling of buildings
Producing and converting organic materials to fuels
Generating electricity

The entire world faces energy-related problems similar to those faced by the United States. Greater international co-operation is needed if these problems are to be solved.

CHAPTER TEN

DRUG ABUSE PROBLEMS

Introduction

Man discovered through the ages that certain plants seemed useful to ease pain, heal sores, and cure disease. It was also found that certain naturally occurring substances produced intoxicating effects and feelings of euphoria or well-being. Soon it was evident that these early drugs could have harmful effects if used improperly. Drug abuse was born of man's inability to control his use of drugs.

There has been a considerable change in the U. S. from early use of simple compounds to the industry that manufactures, packages, and legally sells drugs that cost over six billion dollars per year. The drug industry consists not only of manufacturing firms, but also includes a distribution system which gets the drugs from factories to pharmacies and finally to the consumer.

In 1974 more than 250 million prescriptions were filled by pharmacists. One survey shows that 25 percent of all American women over the age of 30 have prescriptions for amphetamines (diet pills) or barbiturates (sleeping pills). Americans consume nearly 30 million pounds of aspirin each year, or almost seven pounds for every person in the United States. When one adds the cost of drugs, alcohol, and tobacco to the legal drug preparations, the total funds expended for the purchase of selected legal drugs and drug products are over 32 1/2 billion dollars per year or $161 for every man, woman, and child in the United States.

Drug Addiction

It is estimated that the American economy loses several billion dollars each year to the retail trade in illegal drugs. Part of this great loss is due to problems of drug addiction.

The cost of addiction may be grouped into three categories: (1) The cost to the drug dependent person to support his habit -- recent studies estimate that the daily cost of supporting an addiction has ranged from $20 to $100 daily, depending on the location and the availability of drugs. (2) The cost to the community for property stolen by drug dependent people -- in order to support a $20 to $100 a day habit, the drug dependent person must steal property amounting to from two and one-half to five times the actual cost of his habit. This total cost may run between one and two billion dollars per year for the

NOTE: Definitions of those words underlined will be found in a glossary at the end of this section.

nation. (3) The cost to our community for the arrest, detention, trial, probation, imprisonment, parole, and rehabilitation of drug dependent people. Welfare support for families of abusers costs hundreds of millions of dollars. Yearly drug treatment expenses have reached $650 million in addition to $475 million necessary in processing drug dependent persons. In addition, the Federal Government spends nearly $115 million enforcing laws against illegal importation, manufacture, distribution, and possession of narcotics and dangerous drugs.

Drug abuse not only affects the economy in direct costs but is now recognized as a major problem for people in business and industry. Commonly cited problems with employees in rank order are absenteeism, turnover, decreased production, theft, and low morale.

Drug abuse in the United States has produced a national health crisis that has touched all sectors of our society. Each year thousands of people develop diseases such as cancer and emphysema associated with chronic tobacco usage; cirrhosis of the liver, malnutrition, and nerve cell damage associated with amphetamine and alcohol abuse. Simple compounds such as aspirin are often misused. Aspirin poisoning is very common among children and adult overdose many times results in malnutrition and/or stomach ulcers. Some two hundred deaths from aspirin overdose are reported each year. In addition to physical disorders, drug abusers many times suffer emotional disorders directly connected to their drug use. Additional burdens are placed on society by drug dependent people who have become unable to work and must be cared for by society. A concerted effort on the part of adults and youths will be required if the American public is to make progress in the reduction of the drug abuse problem. It is important that people understand the nature and effects of chemicals to which they are likely to be exposed. They should realize that any chemical used in a way other than that prescribed by a physician, as instructed by labeling, or that is prescribed for another person, is drug misuse.

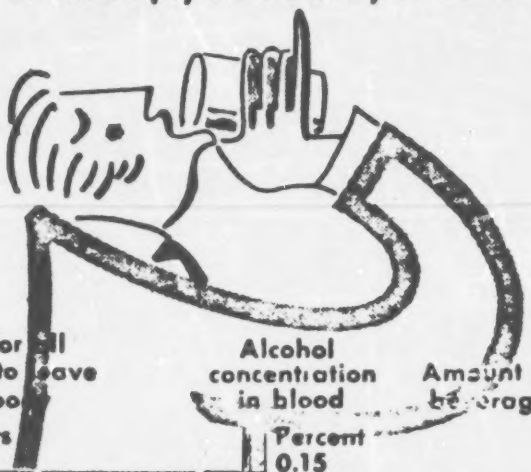
Alcohol

The number one drug of abuse in America today is ethyl alcohol, which is the active ingredient in all alcoholic beverages. Alcoholism is one of the leading health problems in the United States. There are approximately nine million alcoholics in America and it has been estimated that from 65 to 85 percent of the adult population drinks at one time or another. One out of every fifteen drinkers becomes an alcoholic.

An important characteristic of alcohol, also called ethanol, is that it does not have to be digested before being absorbed (visual 114). Upon consumption, the surface tissues of the

Alcohol Levels in the Blood

After drinks taken on an empty stomach by a 150-lb. person



Effects	Time for all alcohol to leave the body — Hours	Alcohol concentration in blood — Percent	Amount of beverage
Gross intoxication	10	0.15	5 highballs (1½ oz. whisky ea.) or 5 cocktails (1½ oz. whisky ea.) or 27½ oz. ordinary wine or ½ pt. whisky
Clumsiness — unsteadiness in standing or walking	8	0.12	4 highballs or 4 cocktails or 22 oz. ordinary wine or 8 bottles beer (12 oz. ea.)
Exaggerated emotion & behavior — talkative, noisy or morose	6	0.09	3 highballs or 3 cocktails or 16½ oz. ordinary wine or 6 bottles beer
Feeling of warmth mental relaxation	4	0.06	2 highballs or 2 cocktails or 11 oz. ordinary wine or 4 bottles beer
Slight changes in feeling	2	0.03	1 highball or 1 cocktail or 5½ oz. ordinary wine or 2 bottles beer
	0	0	

Calories	
5½ oz. wine	115
12 oz. beer	170
1½ oz. whisky	120

Source: Dr. Leon A. Greenberg

TIME Chart by W. Hortens

Visual 114

alimentary canal (intestinal tract) are the first to be irritated. This occurs even before absorption.

The rate of absorption depends on several factors: the amount of alcohol consumed, the rate of consumption, the size of the person, the amount of food in the stomach, and other possible factors. For example, the larger the person, the slower the absorption process. There is a phenomenon which may occur in the stomachs of some people. Drinking can cause the pyloric valve (the opening leading from the stomach to the small intestine) in the stomach to become spastic in the process of closing; thus, the drinker may become nauseated. This condition is known as pylorospasm and helps to keep the person from drinking excessively.

Absorption from the stomach is relatively slow, but becomes rapid in the small intestine and is rapid in the remainder of the system. As this process is occurring, respiration (the process of breathing and using oxygen) may be stimulated if moderate amounts of alcohol are consumed; however, large doses will produce depression.

The alcohol is stored in the tissues until burned up (metabolized) but most of the metabolism takes place in the liver. It is unclear what alcohol actually does to the liver. It is commonly accepted that chronic use may lead to fatty livers and a condition known as cirrhosis, but this disease may result from vitamin deficiency and malnutrition rather than from the alcohol itself. Most chronic abusers of alcohol do not eat properly when they are drinking. Ultimately the alcohol will be carried by the blood to the brain.

Controversy continues concerning whether alcohol destroys brain cells. Due to a number of factors it is difficult to discover precisely what does happen in this respect. According to the American Medical Association, "Actual and irreversible cortical tissue destruction (brain damage) is found eventually after sustained, heavy drinking. There may also be degeneration (loss of function) of peripheral (lying close to the surface of the skin) nerve tissue. These processes may or may not be the result of the direct action of alcohol. Nutritional deficiencies and/or repeated head injuries may be contributors."

Alcohol is popular because with many people it temporarily reduces tension. Even though it is readily accepted and widely available, it is a potentially dangerous drug. Chronic use is harmful to both the individual and the society in which he lives.

Tobacco

Despite the fact the Surgeon General has determined that

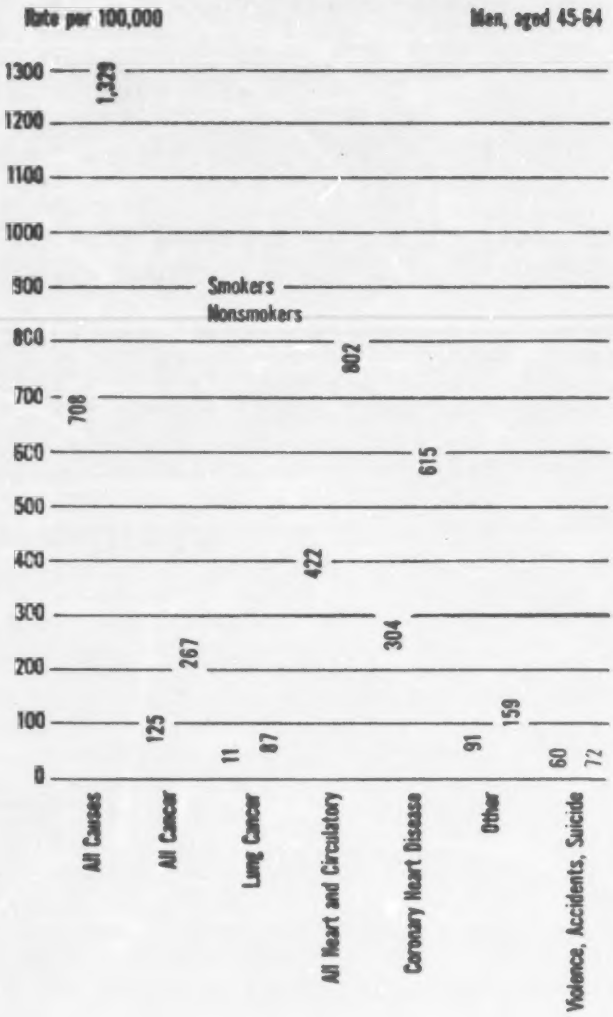
cigarette smoking is dangerous to one's health, the American public continues to smoke at an increasing rate. The discovery that smoking is a hazard to health is the result of over 30 years of research and is supported by every medical and health agency in the world (visual 115). Besides cigarette smoking being the major cause of lung cancer, it is also linked with heart disease, circulatory impairment, chronic bronchitis, and emphysema. Too few smokers realize the degree and extent of health damage associated with cigarette smoking. "Early morning hacking" and "smoker's coughs" are so common that millions of Americans consider these "normal" rather than signals that warn of damage to the body. Each day in the United States, 250 people die from heart attacks, 100 from lung cancer and 150 from other cigarette-related diseases.

Although tobacco contains more than 100 compounds, nicotine, a poisonous liquid, is its principal agent and produces the drug effect that makes smoking habit-forming. If 50 milligrams of nicotine were injected into a vein, the results could be fatal to a human being. But a person could not reasonably smoke enough cigarettes at one time to die of nicotine poisoning. The nicotine found in cigarette smoke prevents the whipping action of the cilia that line the bronchial tubes (those tubes leading from the throat to the lungs). This may be disasterous since the wave-like motion of the cilia propels the mucus that traps foreign materials toward the throat where it can be removed. The smoker's cough is a result of this action.

In addition to nicotine, tobacco smoke also contains carbon monoxide (a poisonous gas) and carcinogens (cancer-causing materials). Although the amount of carcinogenic chemicals found in tobacco is small, they cause constant irritation and over a period of time can change normal cells into cancerous cells. As the smoke travels through the trachea (voice box) to the bronchial tubes and into the lungs, carcinogenic particles are deposited along the way. The accumulation is especially abundant on the lining of the bronchial tubes. This is where most cases of human lung cancer originate. If one inhaled the smoke of a pack of cigarettes a day, he would inhale eight quarts of cancer-producing tar in ten years. Interestingly enough, the risk of lung cancer increases with the duration of smoking and number of cigarettes smoked per day, but is diminished by discontinuing smoking.

Tobacco smoking affects the body in many other ways. The beginning smoker may feel dizzy and nauseated because nicotine affects the vomiting center in the brain (medulla) and the labyrinth (aspiral canal filled with fluid) in the ear which helps maintain body equilibrium (balance). Tolerance to this later develops. Smoking, by causing constriction (narrowing) of the blood vessels of the skin, causes a decreased blood flow to the skin. It also places an extra strain on the heart by increasing blood pressure and heart rate. Many pregnant women do not realize that when they smoke the nicotine passes from

Death Rates of Cigarette Smokers



Smokers have higher death rates than nonsmokers. Note that the heart disease death rate is twice as high for smokers compared to nonsmokers and the lung cancer rate, nearly eight times higher. See: National Cancer Institute Monograph 19, pp. 127-204, 1966.

Visual 115

the mother into the unborn child.

Pipe and cigar smoking is not as hazardous to health as cigarette smoking and the overall death rate is about equal to those of a nonsmoker if the smoke is not inhaled. But for those who smoke heavily or inhale, the health hazards are even greater than those of cigarette smokers. The risk of developing lip cancer and cancer of the mouth and esophagus (the tube leading from the mouth to the stomach) is especially great among pipe and cigar smokers.

Research is underway to help the smoker quit, cut down on smoking or at least make it safer. There are non-tobacco products on the market that are made from vegetable leaves that do not contain nicotine but do produce tars. Some cigarettes have a lower tar and nicotine yield and the filter tip found on many brands helps eliminate the tar. The smoker would help himself if he would not smoke the cigarette all the way down because the tar and nicotine become trapped near the end. If he could give up cigarettes completely, he would feel better, breathe easier and live longer.

Marijuana

The active ingredient in marijuana that is thought to cause the "high" is known as THC (tetrahydrocannabinol). This was first identified in 1964 and chemically produced in 1966. This chemical is unique to the cannabis (marijuana) plant, Cannabis sativa (visual 116). (Cannabia indica, Cannabis americana, and Cannabis mexicana, refer to where the plant is grown; India, America, and Mexico respectively.) Recent research has shown that marijuana contains chemicals similar to those found in tobacco which convert to carcinogens (cancer producing agents) when smoked. It can cause lung cancer and there is also evidence that it may cause emphysema.

The marijuana smoker differs from the cigarette smoker in that he holds the smoke in his lungs for a much longer time and he smokes the marijuana cigarette down to a much shorter length. Holding the smoke in the lungs for a longer period of time and smoking the butt down to a very short stub where most of the tars have accumulated, is one of the major reasons cancer and emphysema are beginning to show with marijuana use.

As every person is chemically and physically unique, so is his reaction to smoking marijuana. When smoked, marijuana rapidly enters the bloodstream. At this point there are several factors that affect the experience achieved by the user. They are (1) the emotional attitude of the user, (2) the environment in which the drug is used, (3) the dosage of the drug, and (4) the personality of the user.

A B

Figure 2.13 Marijuana plant **(Cannabis sativa).** (A) **Cannabis sativa** drawn from a young potted plant. It grows to a height of from 3 to 16 feet. The live green plant has a characteristic odor, is sticky to the touch, and is covered with fine hairs that are barely visible to the naked eye. The flowers, of the female plant, form irregular clusters containing light, yellow-green seeds. The stalks and stems are used in the textile industry for the manufacture of rope, twine, mats, bags, and certain grades of coarse paper. (B) The leaves are compound, of from five to eleven (always an uneven number) leaflets or lobes extending from 2 to 6 inches from the center diagonally to the edges. The two outer lobes are always very small compared with the others. The leaf is deep green on the upper side and a lighter green on the lower side.

Visual 116

Figure 2.16 A flowering branch of the coca plant **(Erythroxylon coca),** a shrub or small tree which grows to 12 to 15 feet. The drug cocaine is extracted from the leaves.

Visual 117

At times an unpleasant experience is produced by marijuana. Instead of achieving the euphoria desired, the opposite occurs. The user becomes depressed and experiences self-pity. (Hallucinations sometimes occur when the marijuana is exceptionally potent or it has been laced with some hallucinogenic drug such as LSD.)

Concentrated marijuana research is just beginning and interesting results are coming to the surface. One symptom that seems common to many chronic users is memory lapses. The user will have no recollection of certain periods of time. The amotivational syndrome, where the regular user loses interest in everything worthwhile and drops out of society, is a major concern and seems to be common to many chronic users. In this condition the user loses interest in his grades, his dress, his friends and becomes totally involved in continuing his marijuana use.

The physical effects of marijuana vary from user to user, but several seem common to most marijuana users. Cannabis affects the eyes in several ways. Bloodshot eyes seem common to all users. Paralysis of the ocular (eye) muscles which control eye movement has been reported.

Evidence is beginning to appear indicating that the continued use of marijuana may inhibit the production of enzymes (substances necessary to combat disease) in the liver. It appears that regular marijuana use causes the liver to be less effective in metabolizing drugs used medically; thus, there is danger of overdose of regular medication due to the inhibiting effects of marijuana on the liver. This is not due to the THC, but from one of the other substances in the gum-like resin of the cannabis plant, cannabidiol. One of the most unusual reported effects is the enlargement of breasts in males (gynecomastia) caused by the continued use of marijuana. The delta 9 tetrahydrocannabinol (THC) is very similar to the female hormone estradiol and when taken in high dosage over a long period of time could cause a female-like effect on a male user.

Chronic use of marijuana seems to produce symptoms similar to those of encephalitis lethargica, an inflamation of the lining of the brain which causes extreme lethargy (total indifference), reversal of sleep rhythms, hallucinations, and loss of memory. This brain atrophy is compared to damage incurred when the brain receives a severe blow; the resulting damage is irreversible.

In experiments comparing the effects of cannabis and alcohol on driving, it was found that cannabis users had more errors and slower performance than the alcohol user when given equivalent intoxicating doses.

Many things have been said and written about marijuana. The ideas, attitudes, and facts depend on the source that is read and vary from harmless to very harmful. At this time, there is not

enough hard-core evidence to swing the marijuana pendulum in either direction, although recent evidence indicates that marijuana may be more dangerous than alcohol or tobacco. Research on the cannabis plant and on the effects of marijuana to the user is still in the early stages of development.

Depressants (Sedative-Hypnotics)

Barbiturates are the most widely abused among the depressant drugs. Barbiturates were introduced into medicine in 1903 by two German scientists. Their discovery, called Veronal, was offered as a controllable means of depressing the central nervous system to any desired degree from slight sedation (calming) to deep anesthesia (sleep).

As early as 1937, the American Medical Association took note of the "Evils from Promiscuous Use of Barbituric Acid and Derivative Drugs." According to the AMA report, these evils include habit formations, substitution of drugs for alcoholic beverages for drunken episodes, and use of the drugs for successful as well as unsuccessful suicidal attempts. By 1949, about one quarter of all poisoning cases admitted to hospitals in the United States were due to acute intoxication from barbiturates; and sleeping pills caused more deaths, either by accidental overdose or by suicidal intent, than any other poison. The Germans first recognized the addiction to barbiturates, including withdrawal symptoms consisting of convulsions and a condition resembling alcoholic delirium tremens.

Barbiturates depress the central nervous system and are prescribed in small doses to induce sleep. They are also valuable in cases of acute anxiety, hyperthyroidism, and high blood pressure. Due to their sedative effects, barbiturates are used to treat both physical and mental illnesses.

There is a class of depressant drugs which are neither barbiturates nor tranquilizers. One in particular, methaqualone, is classified as a sedative-hypnotic. Chemically it is not a barbiturate, but its effects are remarkably similar. It is prescribed generally for insomnia but it has been combined with various other drugs and used to treat peptic (stomach) ulcers, obesity, gastroenteritis, and a host of other disorders. Although methaqualone's effects are similar to those of barbiturates, it appears to act on a different central nervous system site. The exact mechanism by which it exerts its effects is not fully understood. The chronic user of methaqualone can develop tolerance to its effects and physical addiction is not uncommon. Withdrawal symptoms consist of "headache, anorexia, nausea, and abdominal cramps." Again, as with barbiturates, one does not develop complete tolerance to the amount necessary for a fatal overdose. Death may occur from convulsions or respiratory arrest (failure of breathing). A substantial number of deaths have been reported from mixing methaqualone and alcohol.

Stimulants

The first use of amphetamines occurred in 1930. They were actually first used by the government to stimulate more productive war efforts on the part of the civilians and military personnel during World War II. Their use increased after World War II to a major abuse especially involving teenagers.

Amphetamines are drugs that act as stimulants on the nervous system and cause a loss of appetite and insomnia. They are used for diet control, narcolepsy (an overwhelming need for sleep), and help in the control of Parkinson's disease which is a form of paralysis.

Heavy users of the drug take it for its stimulating effect in order to remain awake for long periods of time. Truck drivers, athletes, college students, teenagers, and average housewives have been found to use the drug to excess. College students and even some high school students take excessive amounts of amphetamines, especially during examination periods. It has been said that some students, by taking the drug, have gone without sleep for four to five days at a time. However, if the effects of the drug should wear off (especially during the examination), the student would become completely exhausted and his mind may become blank.

Since the body develops a tolerance to the drug it is necessary for the users to increase their dosages to experience the desired effects. When under the effects of the drug, a person may become excited, talkative, and his hands may tremble. His eyes are affected to the point that the pupils of the eyes become enlarged and the body experiences heavy perspiration.

In serious cases a drug psychosis (mental disorder) develops with delusions and hallucinations, both auditory (hearing) and visual (sight). Continued abuse of amphetamines can cause high blood pressure, abnormal heart beats, and possibly a severe emotional disturbance characterized by unreasonable fears known as paranoid behavior.

Speed is the slang for methamphetamine. Many times brain damage and heart disease result from the use of the drug.

Cocaine is a stimulant drug. It is one of the oldest drugs used by man. It comes from the leaves of the coca shrub and was used by the Spanish and Incas of Peru (visual 117). People who live in the high Andes of Peru and Bolivia find the warm stimulation brought on by the use of the drug a physical help against the cold, fatigue, and hunger of the mountains. It was once used as a local anesthetic in oral and nasal surgery, but has been replaced by less dangerous drugs.

Physical dependence and tolerance do not develop in the abuser of cocain, but psychological dependence does. Depression and hallucinations may persist after a person stops the use of cocaine.

Volatile Substances

There are a number of volatile substances that may not be considered drugs but because they are encountered many times in the drug scene they should be given special consideration. These substances are various inhalants such as glue, gasoline, paint thinner, lighter fluid, aerosol spray, cleaning fluid, nail polish remover, insecticides, and quite a number of others. The average age of a glue sniffer or inhaler is between eight and eighteen.

Upon becoming "high" from inhaling fumes, a person may experience excitement and exhilaration resembling the first phase of alcohol intoxication. The following effects may also be prominent: (1) blurred vision, (2) ringing ears, (3) staggering, (4) slurred speech, (5) tissue irritation from contact, (6) nausea, (7) dizziness, (8) shakiness, (9) muscle spasms, and (10) possible hallucinations. Repeated use can, of course, lead to psychological dependence.

There are also some medical problems which may arise as a result of using inhalants. One possible complication is death by suffocation or depression of respiration. There have also been reports of a severe type of anemia which may be developed in those who have inherited a defect of the blood cells called "sicklecell anemia." Glue sniffing can cause damage to the kidneys, liver, heart, blood, nervous system, and the marrow of the bone.

Hallucinogens

An hallucinogen or psychedelic drug is one that has mind-altering properties and produces hallucinations. There are a number of drugs, most of which are illegitimate, that fall into this category. The user of hallucinogens usually enters into a state which is removed from real life; consequently, this hallucination may cause the person to inflict harm upon himself or others.

Synesthesia (the crossing of the senses) occurs with the use of some hallucinogenic drugs. A person may experience a situation in which he sees a sound or hears a color. It is almost impossible to predict the type of experience that one may have and herein lies the greatest danger associated with the use of hallucinogens.

One of the most well-known hallucinogenic drugs is Lysergic Acid Diethylamide, also known as LSD or LSD-25 (visual 118). Since the drug has no legitimate use at this time, it is manufactured in clandestine laboratories. The laboratories may be

Figure 2.15 The ergot fungus **Claviceps purpurea** shown as it occurs on the head (spike) of a rye plant. The drug LSD (lysergic acid diethylamide) is derived from this fungus.

Visual 118

Figure 2.11 (A) Oriental poppy (**Papaver somniferum**). (B) Capsules, or pods, of the poppy flower. (K. L. Jones, L. W. Shainberg, and C. O. Byer, **Health Science.** New York: Harper & Row, 1968.)

Visual 119

found in unsanitary surroundings. This practically insures that impurities will be found in the drug. The substance may appear to be a colorless, odorless, and tasteless liquid or a white powder. This does not rule out the possibility that other ingredients may be mixed with the drug in order to alter its appearance.

A phenomenon that may occur with the use of LSD is that of the "flashback." This is the recurrence of an hallucination days or possibly even months after the last dose was taken. LSD does not cause physical dependence, but regular use could lead to a psychological dependency. It is also possible that this regular use may enable that user to develop tolerance to the drug. There have been reports that the regular use of LSD may cause a breakage of chromosomes in the body thereby causing birth defects in children. At present this has not been proven scientifically.

Mescaline is an hallucinogenic drug which is obtained from the peyote cactus plant. Even though physical dependence is unlikely to occur, the user may develop a psychological dependency. It is doubtful that there are many regular users of mescaline simply because it is not readily available. It is very easy to take LSD or some combination of psychoactive substances and color them to look like mescaline.

Psilocybin is a drug which is derived from the Psilocybe mushroom. The reactions to this drug along with the physical and psychological effects are very similar to LSD and mescaline. Psilocybin also resembles mescaline in the sense that it is not easily accessible on the streets.

STP is the street name for the compound dimethoxymethamphetamine, also known as DOM. The drug is reported to be even stronger or more potent than LSD. The effects are very similar to other hallucinogens.

DMT, dimethyltryptamine, is a hallucinogen found in the seeds of certain types of plants in South America and other areas. It is also produced synthetically in illegal or underground laboratories. It may produce a psychological dependency but not a physical dependency.

A drug which is becoming more prominent as a substance of abuse is phencyclidine or PCP. Unlike many of the other psychedelics, there is legitimate value in PCP. Veterinarians use the drug as an animal tranquilizer. When converted to street use, the drug becomes a member of the hallucinogenic family of drugs.

Even though THC or tetrahydrocannabinol is normally associated with marijuana, there are reports of THC being synthesized and used as a preparation within itself. It should be pointed out that this process is very difficult and not easily accomplished in clandestine laboratories. This makes THC very scarce in the drug sub-culture.

There are other chemicals which could be listed as hallucinogens and the number will doubtless become larger. At best the majority of these substances are potentially dangerous and of no value to medicine.

Narcotics

Usually the terms narcotics or opiates are applied to drugs which are derived from the opium poppy, Papaver somniferum (visual 119). There are also synthetic drugs that fall into this category. Opium is converted into a morphine base and from this substance such drugs as heroin and codeine are synthesized.

The continued use of narcotic drugs can lead to both physical and psychological dependence. Tolerance development is seen also as a person becomes more dependent on one of these drugs. When the narcotic addict stops taking the drug and withdraws without the aid of medication, this is known as "cold turkey." This is a most painful process and may be one of the chief reasons addicts are hesitant to try to end their habits. It has been reported that a person can be withdrawn physically from heroin within ten days to two weeks; however, the psychological dependency usually induces him to return to it.

The opiate-like drugs act as depressants on the central nervous system. They are very effective as pain relievers as well as causing lethargy (tiredness), drowsiness, and general confusion. Other effects may include constipation, flushing of the skin, depression of the respiratory system, and constriction of the pupils of the eyes. Due to the fact that many addicts do not eat properly, malnutrition may be evidenced. Those who use the drugs intravenously (shot into the veins) may suffer from diseases related to unsterile needles and syringes. There is, of course, the possibility of death from an overdose.

Morphine is a narcotic drug of abuse which has legitimate medical use. It is most effective as a pain reliever. As for its illegitimate use, morphine produces euphoria and is prominent in the drug abuse scene. Tolerance builds very rapidly and physical addiction can occur along with psychological dependence.

Probably the most popular opiate of abuse is heroin. This drug produces a type of euphoria that makes it the choice of the narcotic addict. It is usually mixed with water or some other liquid and injected. It can be inhaled or taken orally (by mouth), but mainlining (shooting into a main blood vessel) the drug gives the abuser a more desired effect.

The heroin user does not take pure heroin. This drug is usually diluted with substances such as quinine or milk sugar. Many addicts take a concentration of less than five percent heroin. Heroin addiction is a most expensive habit and costs

some addicts as much as $100 per day or more. It can be observed readily that as heroin addiction rises in a community, so does the crime rate. Most addicts cannot support their habits financially and may resort to stealing in order to get money for the next fix (dose). Also, the cure rate for heroin is very low and most addicts return to their habits even after undergoing treatment and rehabilitation.

GLOSSARY

ACUTE - severe but not of long duration

ADDICT - (see addiction)

ADDICTION - the compulsive and repetitious use of a drug over which a person has lost the power of self-control to the extent that he becomes harmful to himself and to the society in which he lives

For addiction to occur, three factors must be considered:

1. Psychological dependence (habituation) - psychological dependence is the condition whereby a person desires a drug, but does not suffer from physical ills by its withdrawal. The degree of dependency can range from very mild to a condition in which a person has an intense craving for the drug and obtaining it occupies his thoughts almost completely.

2. Physiological dependence - this occurs when the physiological state of an individual is altered due to the repeated administration of a drug and abstinence of its use causes withdrawal symptoms characteristic for that specific drug. Withdrawal symptoms are a group of characteristic actions and behaviors that ensue upon the discontinuation of a drug and the severity of withdrawal depends on the dosage of the drug taken, the length of time the drug has been used and the type of drug used. An interesting aspect of withdrawal is that the symptoms accompanying withdrawal are opposite the symptoms for which the drug was initially taken. Examples: One of the symptoms of heroin addiction is constipation. With the withdrawal of the drug, diarrhea occurs; use of methamphetamine causes extreme elation, withdrawal brings on severe depression.

3. Tolerance - tolerance to a drug develops when, after repeated use of a drug, a higher and higher dosage must be administered to achieve the original effect. Cross tolerance occurs when tolerance has been established to one drug and transfers to another within the same classification. For example, if the person is tolerant to morphine, he also will be tolerant to heroine, methadone, etc., but not tolerant to barbiturates which are in a different classification.

ALCOHOLIC - one who cannot control his use of alcoholic beverages

ANEMIA - a condition in which there is a reduction of the number of red blood cells in the blood

ANOREXIA - loss of appetite

ANXIETY - a state of being uneasy or worried about what might happen

BRONCHITIS - an inflamation of the tubes leading from the throat to the lungs

CENTRAL NERVOUS SYSTEM - generally refers to the nerve activity in the brain and spinal column

CHROMOSOMES - the formations in body cells which determine bodily characteristics

CHRONIC - lasting a long time

CIRRHOSIS - a disease, especially in the liver, marked by excess formation of connective tissue which causes it to cease to function

CLANDESTINE - conducted with secrecy

CONVULSION - a violent, involuntary contraction or spasm of the muscles

DELIRIUM TREMENS - a state of extreme mental excitement resulting from excessive drinking of alcoholic liquor, and characterized by sweating, trembling, anxiety, and hallucinations

DELUSIONS - a false belief

DEPRESSANT - a drug which lowers the rate of muscular or nervous activity

DEPRESSION - (see depressant)

EMPHYSEMA - a swelling of tissue in the lungs which makes it difficult to breathe

ENZYMES - an organic catalyst

EUPHORIA - an abnormal feeling of well-being, vigor, and health

GASTROENTERITIS - an inflamation of the lining of the stomach and the intestines

HALLUCINATION - seeing objects that are not actually present

HYPERTHYROIDISM - excessive activity of the thyroid gland, characterized by a rapid pulse and sleeplessness

ILLEGITIMATE - not produced or used lawfully

INHALANTS - fume producing substances which are inhaled for their intoxicating effect

INHIBIT - to hold back, restrain, or curb

INSOMNIA - prolonged and abnormal inability to obtain adequate sleep

INTOXICATING - exciting or stupifying by alcohol or a drug to the point where physical and mental control is markedly diminished

INTOXICATION - (see intoxicating)

LEGITIMATE - lawfully produced or used

NAUSEA - a feeling of sickness at the stomach

OBESITY - the state of being very fat or stout

PARANOID - an emotional disturbance characterized by unfounded fears

PHENOMENON - a condition that is very unusual

PHYSICAL DEPENDENCE - (see addiction)

PSYCHEDELICS - a hallucinogen which has mind-altering properties

PSYCHOLOGICAL DEPENDENCE - (see addiction)

RESPIRATORY SYSTEM - the body mechanism (lungs, etc.) responsible for the process of breathing

SEDATIVE-HYPNOTIC - a drug which tends to soothe, quiet, or put one to sleep

SPASTIC - relating to or characterized by spasm

SYNTHESIZED - (see synthetic)

SYNTHETIC - an artificially produced substance

SYNTHETICALLY - (see synthetic)

TOLERANCE - see addiction

TRANQUILIZER - a drug used to reduce anxiety and tension without impairing mental alertness

WITHDRAWAL - the process of taking a person off of a drug to which they are addicted or the effects experienced when one is taken off such a drug

WITHDRAWN - (see withdrawal)

CHAPTER ELEVEN

CRISIS IN THE STREETS

Kenneth and his younger sister Louise were new students at Anytown High School. Kenneth had worked hard for years and had maintained a rigorous program of practice to develop and refine his talent and skill at basketball. He was eager to begin practice at his new school. Anytown needed a good player because its best players had been graduated and the only hope of a winning season was to find someone with Kenneth's ability. Louise took a great deal of pride in her brother's sports record.

Kenneth and Louise's first visit to the school cafeteria was a typical lunch hour. The yelling and shouting were at a decibel level of between 80 and 85. Some of the students ran to leave the room after eating and bumped into other students carrying trays. Louise was one of those who was pushed down, spilling hot soup over her hands and new clothes. Other students fought over chairs at the tables, resulting in damaged and broken furniture. Some permitted their friends to cut into the food line. This practice of breaking in line forced Kenneth to lose his place five times. Two boys began throwing grapes at several of the girls. Others immediately began to do the same. On his way out, Kenneth stepped on one of the many grapes that cluttered the floor. He was not able to regain his balance and fell, severely fracturing his right arm.

The next day the guidance counselor called Kenneth and Louise into his office to inquire as to how they liked Anytown High School and what suggestions would they offer to improve the school. These questions were asked of all new students.

If you were either Kenneth or Louise, how would you have answered the question?

When people live together there must be some understanding as to how they are going to live. Everyone wants as much freedom as possible to pursue his own personal interests and way of life. Yet, it is readily apparent as we noted in the cafeteria of Anytown High School, that if each person is permitted to do anything he wishes, and, if every member of the group was doing so at the same time, tremendous conflicts would result. For example, what would happen if you wanted to cross the street at a busy intersection with no traffic light or policeman to interrupt the constant flow of vehicles and the goal of all the drivers was to get to their destinations without slowing down or stopping? What would be the results if you and your teammates wanted to play a game by one set of rules and the visiting team wanted to play by other regulations? What kind of conflicts would occur if your family spent a lot of time and money remodeling your home and a larger family decided they wanted it for themselves?

As we see, the multitude of competing interests and conflicting

purposes people possess make rules and regulations necessary. By establishing regulations we organize and compromise our interests and activities so that everyone in the group has the chance to achieve his most important personal interests without unduly interfering with and, perhaps, causing injury to others. A small group, such as a family, club, class or school organization, or religious institution, calls these governing principles rules or codes. A larger group, such as a community, state, or nation, calls them ordinances, statutes, or laws. The primary purpose of these rules or laws is not simply to restrict, but to restrict in order to protect and safeguard.

Americans believe in the worth of each individual. Thus, we believe that our laws are established in order to protect and serve the individual. The freedom of the individual, however, must always be balanced against the interests of others and society as a whole.

A person is free to choose what work or profession he wishes to enter. He can select the field of medicine, but in order to practice he must satisfy the qualifications set by the state. He is at liberty to determine where he wants to live, but he cannot build his home on land needed for public thoroughfare. His right to travel does not mean that he can drive across his neighbor's yard. He is free to rear his family according to personal creed, but the law obligates him to send his children to school and to provide for their basic needs.

Everyday life reflects two centuries of law and justice that have been modified to meet the constantly changing needs of the people. Some of the basic ways in which law serves our needs are:

1. Protecting the basic freedoms guaranteed by the Constitution

2. Protecting persons and property against wrongdoers

3. Assuring that food and other basic necessities meet minimum standards of quality

4. Combating social injustice

5. Enforcing and regulating the agreements and other voluntary arrangements into which we enter

6. Providing compensation for accidents and other misfortunes

7. Establishing public education and monitoring the quality of instruction

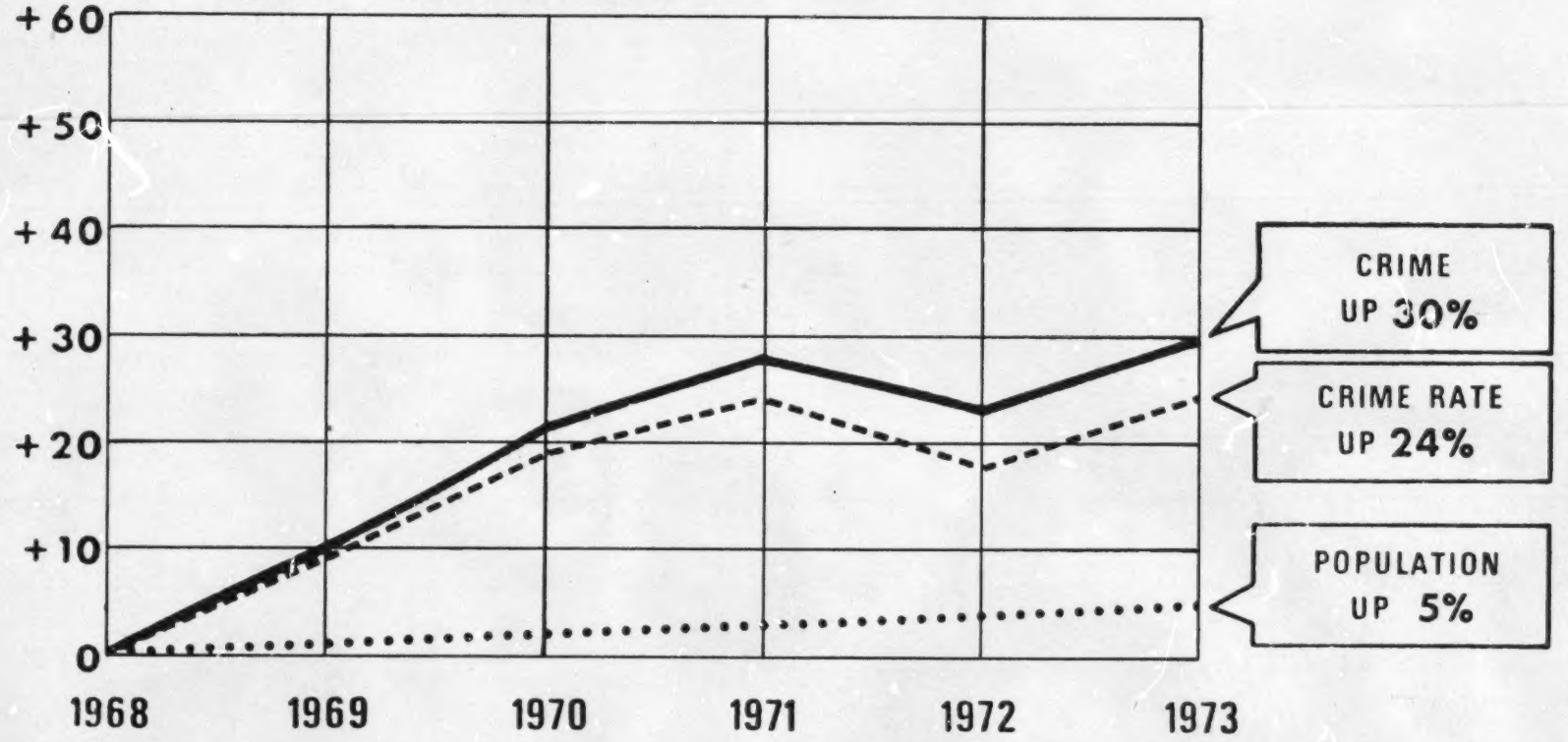
8. Providing sanitation services, public health needs, safety benefits, improved roads, and fire protection

CRIME AND POPULATION

1968 - 1973

PERCENT CHANGE OVER 1968

CRIME = CRIME INDEX OFFENSES
CRIME RATE = NUMBER OF OFFENSES PER 100,000 INHABITANTS



Visual 120

TOTAL ARRESTS BY AGE, 1972

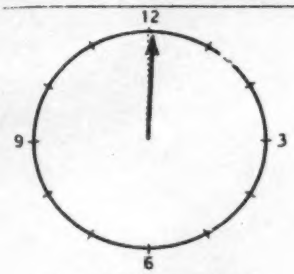
GRAND TOTAL ALL AGES	AGES UNDER 15	AGES UNDER 18	AGES 18 and OVER	AGE					
				10 and under	11-12	13-14	15	16	17
7,013,194	665,887	1,793,984	5,219,210	80,551	149,785	435,551	359,504	403,311	365,282
*100.0	9.5	25.6	74.4	1.1	2.1	6.2	5.1	5.8	5.2

AGE										
18	19	20	21	22	23	24	25-29	30-34	35-39	40-44
352,707	318,227	288,896	285,833	262,983	232,559	216,690	736,398	533,558	450,929	433,116
5.0	4.5	4.1	4.1	3.7	3.3	3.1	10.5	7.6	6.4	6.2

AGE					
45-49	50-54	55-59	60-64	65 and over	Not Known
381,191	299,747	192,199	119,412	101,775	12,991
5.4	4.3	2.7	1.7	1.5	0.2

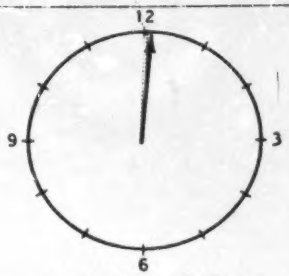
* Percent Distribution

CRIME CLOCKS
1973



SERIOUS CRIMES

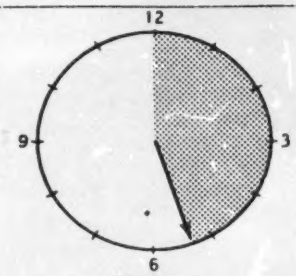
16 EACH MINUTE



VIOLENT CRIMES

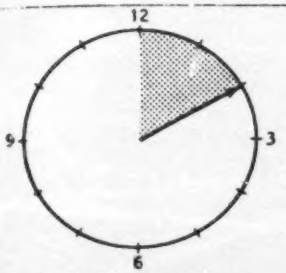
MURDER, FORCIBLE RAPE, ROBBERY OR ASSAULT TO KILL

ONE EVERY **36** SECONDS



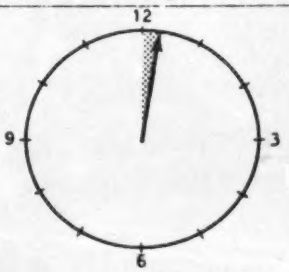
MURDER

ONE EVERY **27** MINUTES



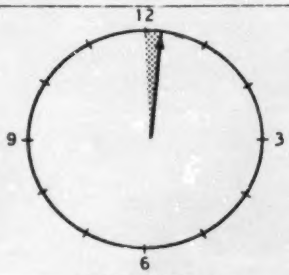
FORCIBLE RAPE

EVERY **10** MINUTES



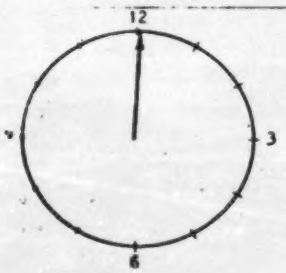
AGGRAVATED ASSAULT

ONE EVERY **76** SECONDS



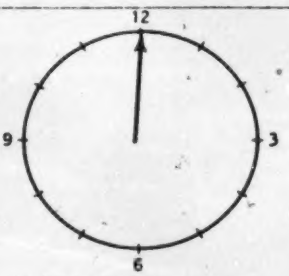
ROBBERY

ONE EVERY **82** SECONDS



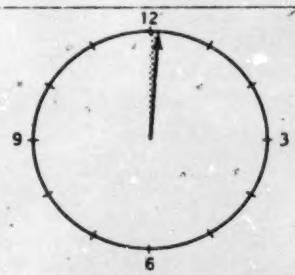
BURGLARY

EVERY **12** SECONDS



LARCENY-THEFT

ONE EVERY **7** SECONDS



AUTO THEFT

ONE EVERY **34** SECONDS

Visual 122

Gradually corroding the peace and security of law and justice are elements of social disorder and confusion that must be examined closely. During the 1960's while the census indicated a population increase of ten percent, the criminal offenses that were reported increased 90 percent. During the same period of time the rates for violent crimes went up approximately 60 percent and property crimes soared to over 80 percent.

Since 1968 crime is up 30 percent, crime rate up 24 percent and the population increase only five percent (visual 120).

Young people were seriously involved in this increase in crime. Arrests of young people from 10 to 17 years of age increased 69 percent while the population figures indicated that there was only an increase of 22 percent for this age group. This denotes that juvenile crime rates rose at least three times faster than juvenile population (visual 121).

The current decade mirrors basically the same trend. As reflected by state reports to the FBI, in 1973 there were at least 16 serious crimes committed every minute. Someone was seriously assaulted every 76 seconds. An automobile was stolen every 34 seconds; that resulted in 76,235 stolen cars per month or 914,820 per year. A robbery was committed every 82 seconds. A murder occurred every 27 minutes. Said another way, on an average day 53 persons were murdered, another 1,136 were assaulted, 2,541 automobiles were stolen, and 1,053 persons and businesses were robbed (visual 122).

During this same year law enforcement agencies made an estimated 8.7 million arrests for all criminal offenses except traffic violations. The arrest rate was 41 arrests for each 1,000 inhabitants. A significant proportion of this arrest rate was youthful offenders. National statistics reveal that persons under 15 years of age made up nine percent of the total number taken into custody. Those under 18 years of age made up 26 percent of the arrests. The twenty-four-year-olds and under swelled the percent to 54.

We would be vitally concerned if crime rates had been steadily increasing since the beginning of history. This is not true and it appears that these rates have their ups and downs. In 1862, for example, ten percent of the entire population of Manhattan was arrested at some time during that year. Crime rates during the depression years (1929-1940) were often much lower than previous or subsequent years.

"Children today love luxury. They have bad manners, a contempt for authority, a disrespect for their elders, and they like to talk instead of work. They contradict their parents, chatter before company, and terrorize their teachers." This is a statement made by Socrates and emphasizes the fact that today's young people did not invent juvenile delinquency. An Egyptian priest, 4,000 years ago, wrote, "Youth is disintegrating. The

youngsters of the land have a disrespect for their elders and a contempt for authority in every form. Vandalism is rife, and crimes of all kinds is rampant among our young people."[1]

William Bradford and Edward Winslow in their journal of the Plymouth Colony record in full detail the pranks of one of the *Mayflower's* passengers. "The fifth day [of December, 1620]," so the journal relates, "we through God's mercy escaped a great danger by the foolishness of a boy, one Francis of Billintons sonnes, who in his fathers absence had got gun powder and shot off a piece or two and made squibs, and there being a fowling piece charged in his fathers cabbin shot her off in the cabbin. There being a little barrel of powder halfe full scattered in and about the cabbin, the fire being within foure foote of the bed betweene deckes and many flints and iron things about and so many people about the fire. And yet by God's mercy no harme was done."

Additional accounts of America's first juvenile delinquents are noted in Governor Bradford's personal history of the colony.

Quite obviously there has always been juvenile crime. However, if the present trends indicating serious increases in juvenile crime rates are not checked, what will the future hold for the youth in our society? "He threatens the innocent who spares the guilty." This statement of Sir Edward Coke, an English jurist of the early 17th century, stresses the fact that every generation of people must be interested in and concerned about law and justice before such social problems can be solved. In any community, especially in a democracy, the solution can be achieved only through the cooperative efforts of everyone, including its youthful citizens.

The laws of our country are built on fundamental, simple principles, in turn founded on basic rules of right and wrong, common sense, and good reason. Common law, statutory law, case law, and administrative laws are examples of the many kinds of law.

The fundamental law of this nation grew out of the rules by which the Anglo-Saxons had dealt with each other for hundreds of years. This is the common law which originated in England. Every state in the United States, except Louisiana, respects and follows, at least in part, the common law.

Laws are created in several ways. On the state level, laws created by city and county governments are called ordinances. When ruled upon by city, county, and state courts, they become case laws. When they are created by state legislatures, they are referred to as statutes. On the federal level, they are created by action of Congress and are also called statutes.

[1]Hugh Boyle, Delinquency and Crime (West Haven, Connecticut: Pendulum Press, 1969), p. 17.

When laws are ruled upon by federal courts they, too, become case laws. Administrative rules and regulations are created by such agencies of government as the Securities and Exchange Commission, the Veterans Administration, or the Federal Communications Commission.

All laws can be divided into two very broad classifications, civil law and criminal law. Civil law governs the affairs that exist between individuals, between an individual and a business or a government agency, or any combination of these concerns. Because the law endeavors to right wrongs, when an individual (a business or a corporation may also be considered an individual) feels he has been wronged by another, he can take his grievance into civil court. The court may award the person harmed an amount of money to compensate for his loss, or it may compel the person who acted unfairly or carelessly to make other amends.

There are many types of civil law cases. One of the most basic civil law relationships is the contract. The smooth functioning of our economy and society in general is dependent to a large degree upon the assurance that once an agreement (written or oral) has been made voluntarily, it will be honored and kept. The Constitution of the United States guarantees this in Article 1, Section 10, "No State shall...pass any Bill... or Law impairing the Obligations of Contracts..." This safeguard is becoming more and more significant to the young consumer since manufacturers and merchants are competing for the teenage dollar. In 1970, for example, persons in the 14-25 age group earned approximately $45 billion and influenced the spending of about $135 billion in the market place. Teenage charge accounts and credit cards are readily available. Both a charge account and a credit card application are forms of a contract.

A criminal action is initiated by either a state or the Federal Government against an individual charged with having committed a crime. A crime is a wrongful act that causes injury or harm to a person, property, or society in general. Each crime must be defined as such in a statute. Thus, we might say that criminal law regulates public conduct and prescribes the duties we owe society.

Crimes are divided into two classes: felonies and misdemeanors. A felony is generally a major or serious offense and punishable by death or incarceration (imprisonment) in a penitentiary for more than one year. A misdemeanor is a minor infraction of the law, punishable by a fine or incarceration in a jail, but not a penitentiary, for a year or less.

Different countries have varying opinions about the seriousness of an offense. The country usually denotes the degree of offensiveness it regards the criminal act by the punishment awarded to the delinquent. To illustrate: arson may be punished by death in France, yet in Russia the arsonist may receive

only eight years at hard labor; larceny may be punished in Argentina by imprisonment from one month to one year and in Japan up to seven years; in France the punishment for participation in a riot may be hard labor for 5 to 20 years, in Japan the punishment may be life imprisonment, and in Argentina it is only one to five years. How do these punishments compare with the penalties imposed upon the convicted by our federal or your state courts for these crimes? Why do you suppose all countries do not have uniform penalties? You may want to make other comparisons, especially in the drug laws.

Laws protect society. Thus, a society is only as safe as the degree to which its laws are obeyed. No society can exist without this obedience to law. In a dictatorship obedience is usually rooted in the fear of the consequences of law violation. In a democracy obedience is motivated by respect for the law and the society it protects.

Laws do not always command popular approval. In a democracy we have the privilege of choice in the enactment of laws. No one, however, has a privilege of choice in the obeying of laws once they are made. A turn-of-the-century President of the United States made this point when he stated:

> Laws, of course, represent restrictions upon *individual* liberty, and in these very restrictions make liberty more secure. For the common good, the individual surrenders something of his privilege to do as he pleases, and so organized society is possible. It is successful just about in proportion as laws are wise, as they represent deliberate and intelligent public opinion, and as they are obeyed. Civilization had to travel a long way before it came to be commonly accepted that even an unwise law ought to be enforced in orderly fashion, because such enforcement would insure its repeal or modification, also in orderly fashion, if that were found desirable.
>
> I do not see how any citizen who cherishes the protection of law in organized society may feel himself secure when he himself is the example of contempt of law. Clearly there is call for awakened realization of true self-interest on the part of the few who will themselves suffer most when reverence for law is forgotten and passion is expressed in destructive lawlessness.

What is law? It is a method for correcting unfairness and creating new benefits; a principle of moral standards and a guide to social justice and order.

There is nothing which should be more vigilantly maintained

than the spirit of acceptance of law. Disregard for law destroys government and the guarantee of individual freedom and liberty. It is the responsibility of *all* who wish to enjoy these freedoms to safeguard and preserve the conditions that make liberty under law a reality.

CONCLUSION

In all the issues that have been discussed in the preceding chapters the central theme that appears to connect every problem with every other problem is survival. Survival has a common thread -- that of the individual and his reaction. If every person in this country is knowledgeable about how to survive; if he understands how law is designed to protect him and to guarantee his freedoms; if he comprehends how his local, state, and national governments function in order to achieve all of this; then he can better understand his role in our contemporary society. It is necessary that each citizen becomes informed and that each person desires to participate in order that the total community can benefit from realistic democracy in practice. Informed citizens can be a part of the changing times and can positively assist in modifying the laws to meet these changing needs. It then becomes truly a government of the people, by the people, and for the people.

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